

Laurel Electronics Co., Ltd.

SPECIFICATION FOR TFT LCD MODULE

MODEL NO.: LT043A-03A

4.3", 480(RGB) x 272 PIXELS TFT LCD MODULE

REVISION	PREPARED	CHECKED	APPROVED
0.1	Y.D.Y.	L.Y.J.	L.Y.

RECORD OF REVISION

Date	Revision	Page	Revision Items
2014-05-12	0.1	-	New release

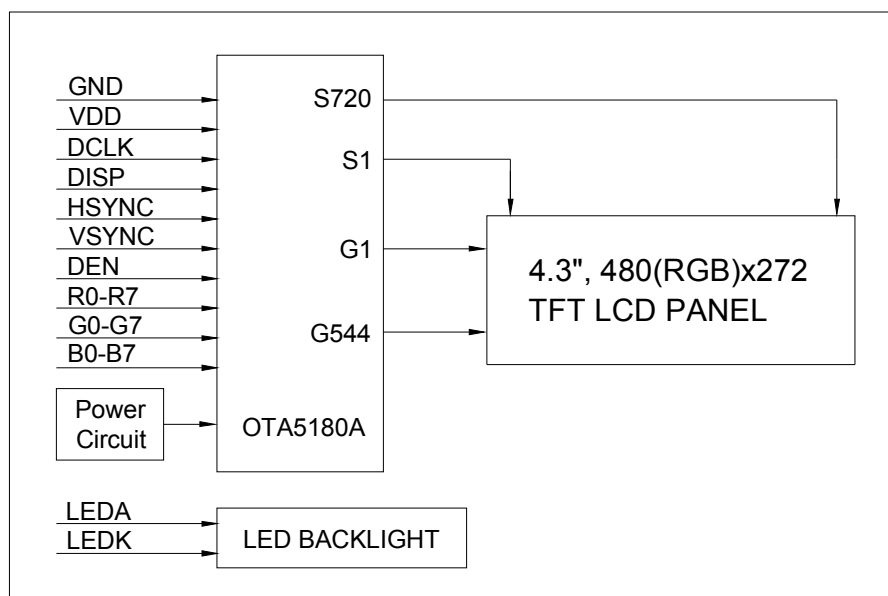
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1. General Description

Item	Specifications	Unit
LCD Type	TFT, Transmissive, Normally White	-
Number of Dots	480x3(RGB)x272	dot
Display Color	16.7M	-
Color Configuration	RGB-Stripe	-
Screen Size	4.3(Diagonal)	inch
Active Area (W×H)	95.04×53.856	mm
Dot Pitch (W×H)	0.066×0.198	mm
Outline Dimensions (W×H×T)	105.4×67.15×2.9	mm
Viewing Direction	6:00	O'clock
Controller	OTA5180A	-
VDD	3.3	V
Data Transfer	24 Bits Parallel	-
Backlight	White LED	-
Touch Panel	None	-
Operating Temperature	-20 to +70	°C
Storage Temperature	-30 to +80	°C
Weight	45	g

2. Block Diagram



3. Interface Specification

Pin No.	Symbol	Description
1	LEDK	LED backlight cathode
2	LEDA	LED backlight anode
3	GND	Power ground
4	VDD	Power supply (3.3V)
5	R0	Red data (LSB)
6	R1	Red data
7	R2	Red data
8	R3	Red data
9	R4	Red data
10	R5	Red data
11	R6	Red data
12	R7	Red data (MSB)
13	G0	Green data(LSB)
14	G1	Green data
15	G2	Green data
16	G3	Green data
17	G4	Green data
18	G5	Green data
19	G6	Green data
20	G7	Green data(MSB)
21	B0	Blue data(LSB)
22	B1	Blue data
23	B2	Blue data
24	B3	Blue data
25	B4	Blue data
26	B5	Blue data
27	B6	Blue data
28	B7	Blue data(MSB)
29	GND	Power ground
30	DCLK	Data clock. Latch data at falling edge
31	DISP	Display on/off control. H: Display on L: Display off
32	HSYNC	Horizontal sync signal. Negative polarity
33	VSYNC	Vertical sync signal. Negative polarity
34	DE	Data enable. Active "H" to enable input data.
35	NC	No connection
36	GND	Power ground
37	NC	No Connection
38	NC	No Connection
39	NC	No Connection
40	NC	No Connection

4. Absolute Maximum Ratings (Note 1)

Item	Symbol	Min.	Max.	Unit	Remark
Supply Voltage (Logic)	VDD	-0.3	4.5	V	
Input Signal Voltage	VI	-0.3	VDD+0.3	V	
Supply Voltage (LED)	If	-	25	mA	
Operating Temperature	Top	-20	70	°C	Note 2, 3
Storage Temperature	Tstg	-30	80	°C	Note 2, 3

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed.

Note 2: 90% RH Max. (Max. wet-bulb temperature is 60°C)

Max. wet-bulb temperature is at 60°C or less. No condensation (no drops of dew).

Note 3: In case of temperature below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

5. Electrical Characteristics

5.1 TFT LCD

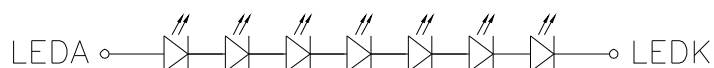
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Voltage	VDD	3.0	3.3	3.6	V	-
Input Logic High Voltage	VIH	0.7VDD	-	VDD	V	-
Input Logic Low Voltage	VIL	0	-	0.3VDD	V	-
Current for LCD	IDD	-	20	25	mA	VDD=3.3V

5.2 LED Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
LED Current	IL	-	20.0	22.0	mA	
LED Voltage	VL	-	21.0	22.0	V	Note 1
LED Life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED voltage is defined by the number of LED at Ta=25°C and IL=20mA.

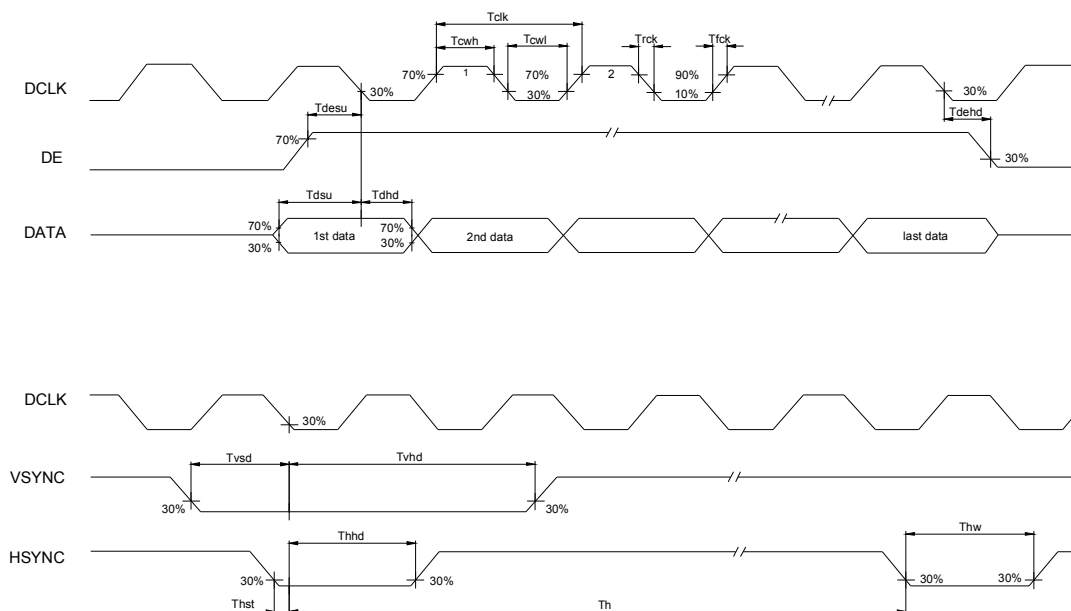
Note 2: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=20mA. The LED life time could be decreased if operating IL is larger than 20mA.



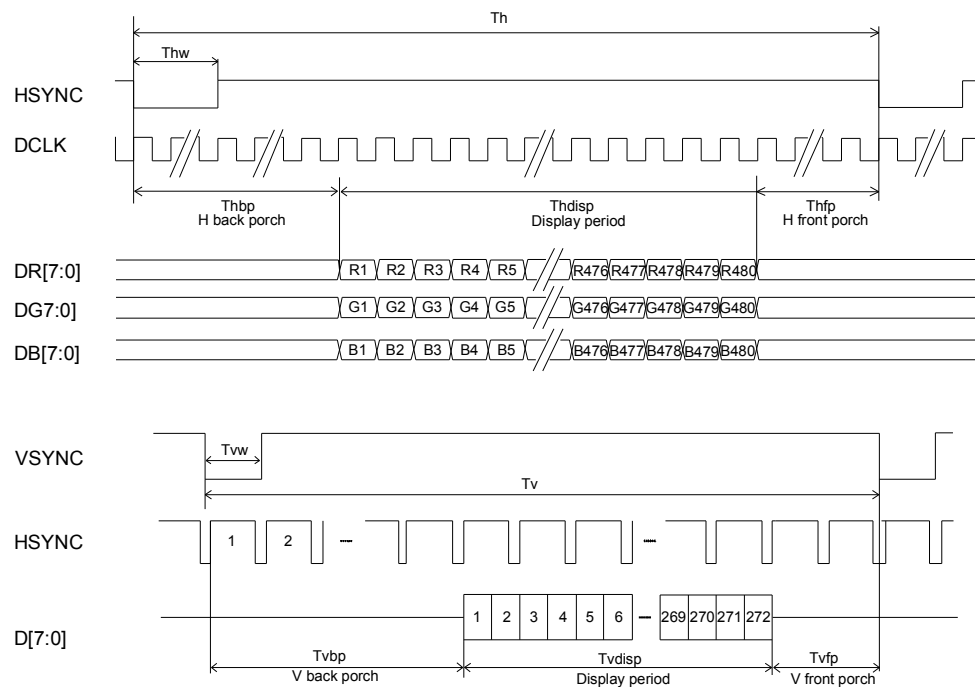
LED Backlight: 7 LED

5.3 AC Characteristics (VDD=3.3V, Ta=25°C)

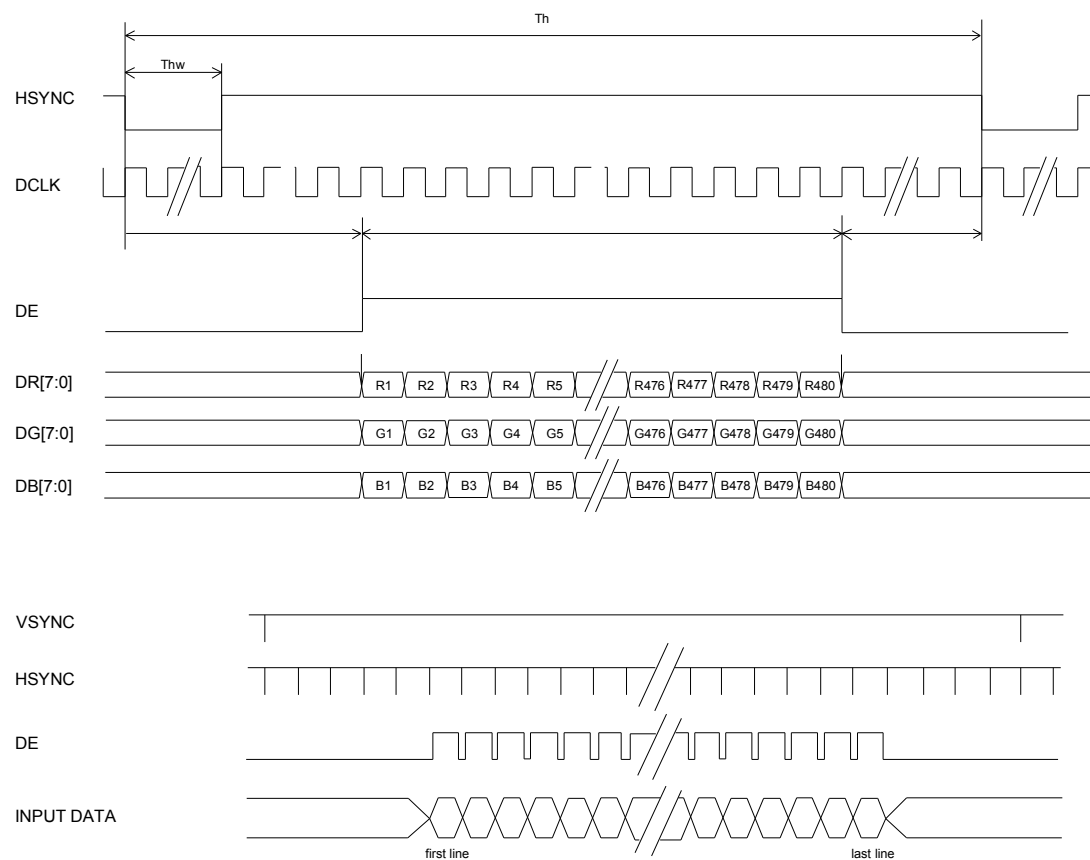
Item	Symbol	Min.	Mid.	Max.	Unit	Remark
DCLK frequency	Fclk	5	9	12	MHz	
DCLK period	Tclk	83	110	200	ns	
DCLK pulse duty	Tcwh, Tcwl	40	50	60	%	
HSYNC width	Thw	1	-	-	DCLK	
HSYNC period	Th	55	60	65	us	
VSYNC setup time	Tvst	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
HSYNC setup time	Thst	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
Data set-up time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	
HSYNC period	Th	490	531	605	DCLK	
HSYNC display period	Thdisp	-	480	-	DCLK	
HSYNC back porch	Thbp	8	43	-	DCLK	By H_BLANKING setting
HSYNC front porch	Thfp	2	8	-	DCLK	
HSYNC pulse width	Thw	1	-	-	DCLK	
VSYNC period	Tv	275	288	335	H	
VSYNC display period	Tvdisp	-	272	-	H	
VSYNC back porch	Tvbp	2	12	-	H	By V_BLANKING setting
VSYNC front porch	Tvfp	1	4	-	H	
VSYNC pulse width	Tvw	1	10	-	H	



5.4 SYNC Mode Timing Diagram



5.5 SYNC-DE Mode Timing Diagram

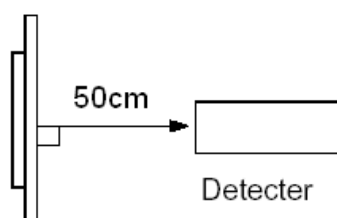


6. Optical Specification

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\Theta=0^{\circ}$ $\Phi=0^{\circ}$	-	200	-	cd/m ²	1
Uniformity	\triangle Bp			70%	-	-	-	1, 2
Viewing Angle	Hor	Θ_R	Cr \geq 10	-	55	-	degree	3
		Θ_L		-	55	-		
	Ver	Θ_U		-	40	-		
		Θ_D		-	50	-		
Contrast Ratio	Cr		$\Theta=0^{\circ}$ $\Phi=0^{\circ}$	180	300	-	-	4
Response Time	Tr + Tf			-	30	45	ms	5
Color Coordinate	Wx		$\Theta=0^{\circ}$ $\Phi=0^{\circ}$	0.26	0.31	0.36	-	1, 6
	Wy			0.28	0.33	0.38	-	

Test conditions: VDD=3.3V, IL=20mA (LED backlight current), the ambient temperature is 25°C.

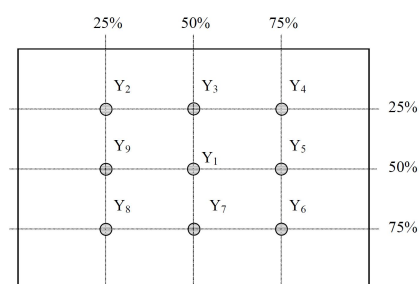
Note 1: The optical characteristics should be measured in dark room after 15 minutes operation. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7.



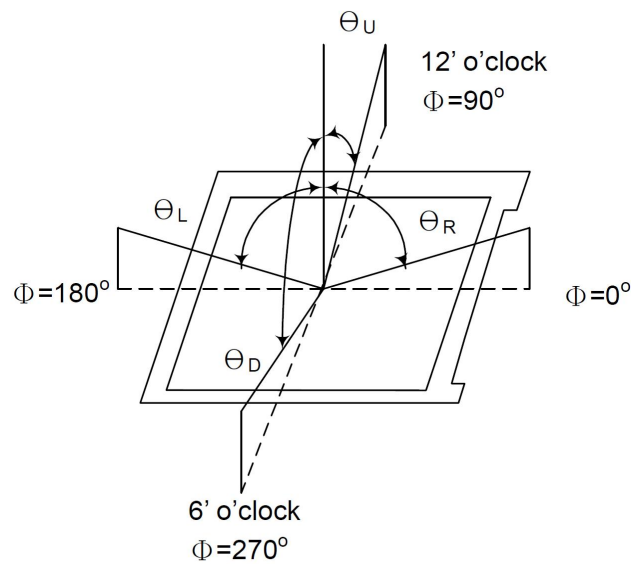
Note 2: $\Delta Bp = Bp \text{ (Min.)} / Bp \text{ (Max.)} \times 100 \text{ (\%)}$

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.



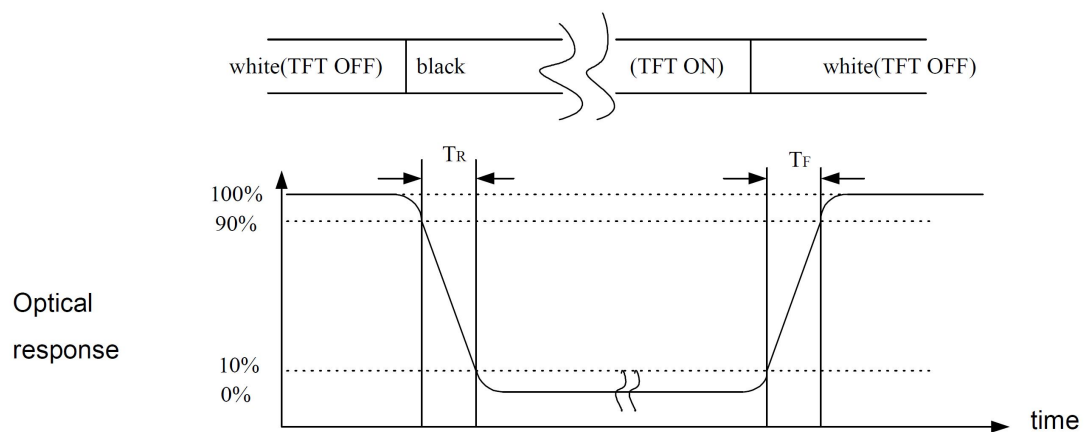
Note 3: Definition of Viewing Angle



Note 4: Definition of Contrast Ratio

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

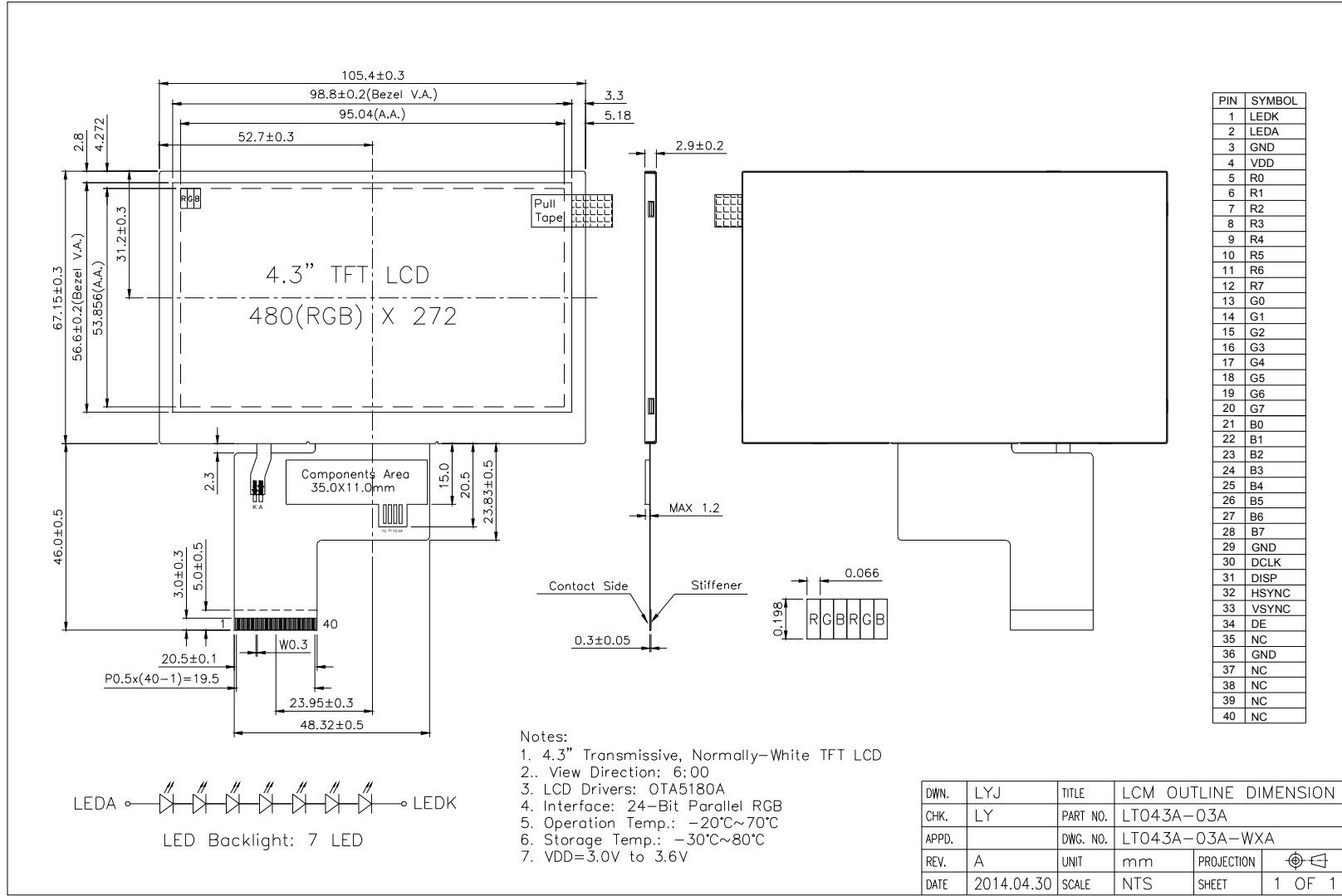
Note 5: Definition of Response Time



Note 6: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

7. Outline Dimension



8. PRECAUTIONS FOR USE OF LCD MODULE

8.1 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.

8.2 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.

8.3 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.

8.4 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,