

Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 480272A TMH-PW-N

**4,3" TFT
with CPU-Interface**

Product Specification

Ver.: 0

07.12.2011

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1. General Description and Features

DEM 480272A TMH-PW-N is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT-LCD module, a driver circuit , a back-light unit. The resolution of a 4.3" contains 480xRGBx272 dots and can display up to 16.7M colors. The following table described the features of DEM 480272A TMH-PW-N.

1.1 Features

- Transmissive and backlight with 7th LEDs are available.
- TN (Twisted Nematic) mode.
- 8 Bits 8080 system interface
- RoHS Compliance

1.2 LCD Module

Item	Specification	Unit
Screen Size	4.3 Inches	Diagonal
Display Resolution	480 (H) x RGB x 272 (V)	Pixel
Active Area	95.04 (H) x 53.856 (V)	mm
Display Mode	Normally White Mode/ Transmissive/ Wide View	--
Pixel Arrangement	R,G,B Vertical Tripe	--
Surface Type(TSP)	Transparent	--
Surface Hardness (TSP)	7H	
Pixel size	0.198 (H) x 0.198 (V)	mm
Display Color	16.7M Colors	--
Viewing Direction	6 o'clock (Gray Inversion)	--
Input Interface	8 Bits i8080 system interface	--
LCD controller	SSD1963	--

2. Mechanical Information

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	105.5	--	mm (1,2)
	Vertical (V)	--	67.2	--	mm (1,2)
	Thickness (T)	--	4.65	--	mm (1)
Weight	--	TBD	--	g	--

Note (1) Not include Component. Refer to the Outline Dimension Drawing as attached.

(2) Backlight unit is included.

3. Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-30	80	°C	(1)
Operating temperature	T _{OPR}	-20	70	°C	(1,2,3)

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.1.2 Electrical Absolute Maximum Ratings

(V_{SS}=GND=0)

Parameter	Symbol	Min.	Max.	Unit	Remark
Power supply voltage	VCC	-0.5	4.5	V	

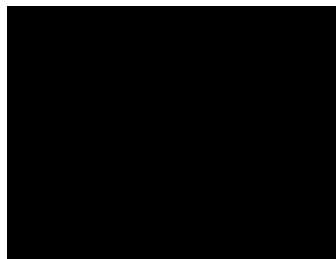
3.2 Electrical Characteristics

3.2.1 DC Electrical Characteristics of the TFT LCD

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	VCC	3.0	3.3	3.6	V	
Power Supply current	ICC		(20)	(30)	mA	Note 1

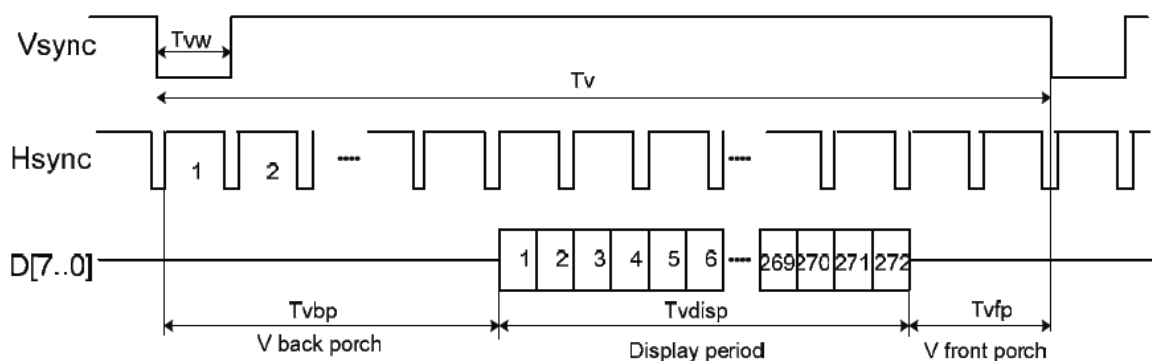
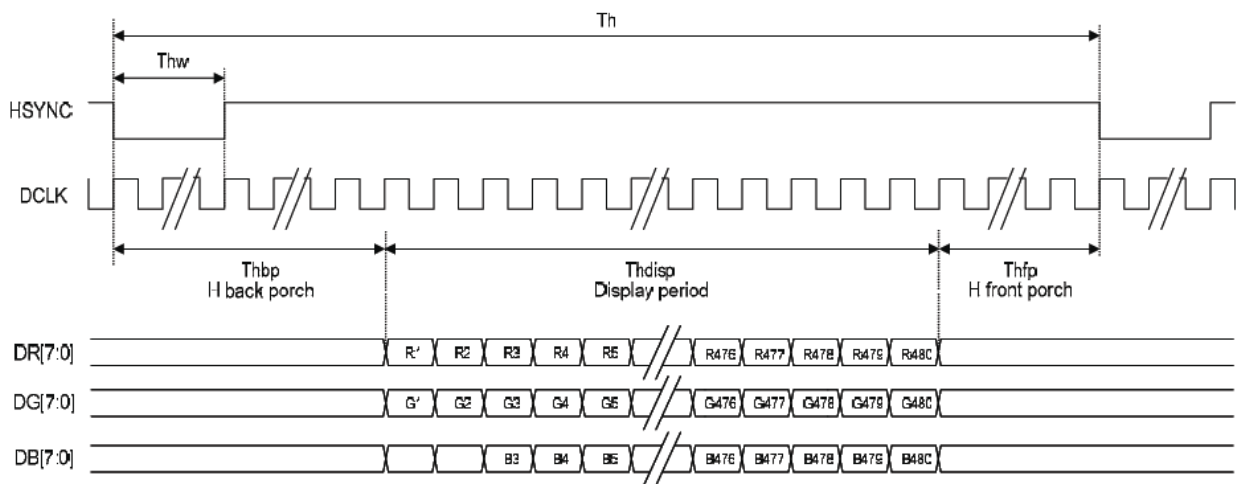
Note1: fv =60Hz , Ta=25°C , Display pattern : Black pattern



3.3 AC Timing Characteristic of The LCD

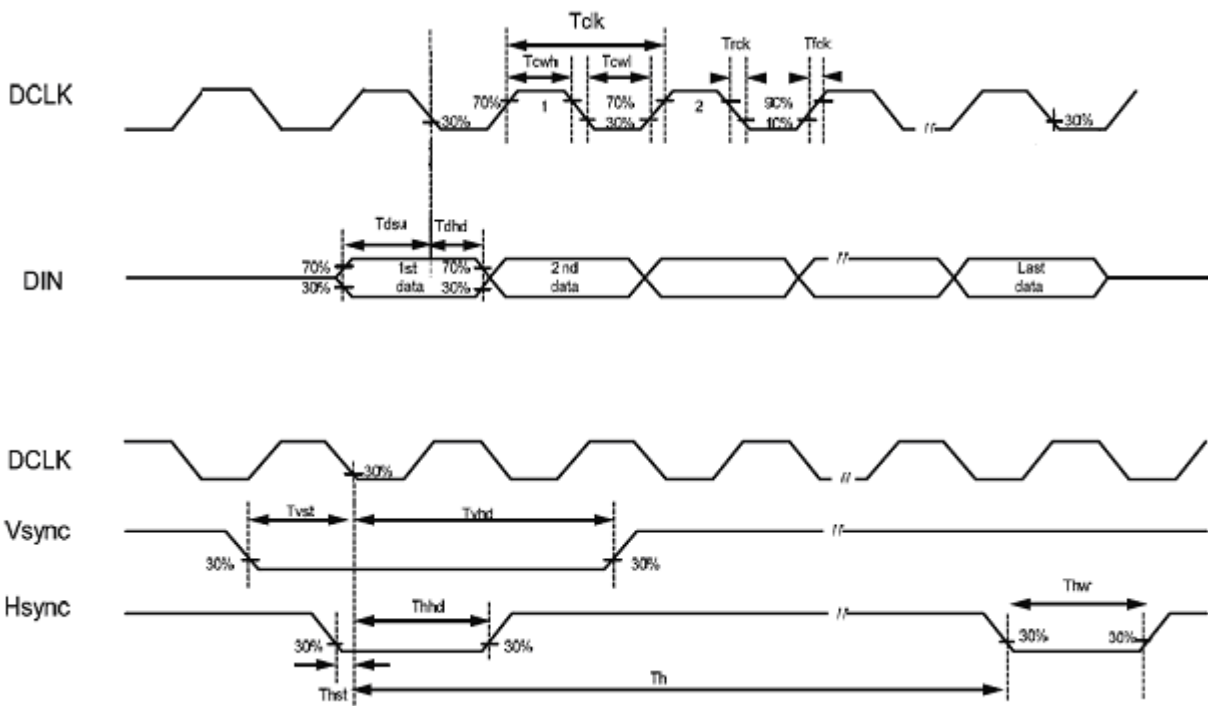
3.3.1 Timing Condition

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	DCLK frequency	Fclk	5	9	12	MHz	
	DCLK period	Tclk	83	110	200	ns	
Hsync	Period Time	Th	490	531	605	DCLK	
	Display Period	Thdisp	-	480	-	DCLK	
	Back Porch	Thbp	8	43	-	DCLK	
	Front Porch	Thfp	2	8	-	DCLK	
	Pulse Width	Thw	1	-	-	DCLK	
Vsync	Period Time	Tv	275	288	335	H	
	Display Period	Tvdisp	-	272	-	H	
	Back Porch	Tvbp	2	12	-	H	
	Front Porch	Tvfp	1	4	-	H	
	Pulse Width	Tvw	1	10	-	H	



3.3.2 AC Timing Waveform

Parameter	Symbol	Min	Typ	Max	Unit
CLK pulse duty	Tcw	40	50	60	%
Hsync width	Thw	1.0	-	-	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 </td
Hsync hold time	Thhd	12	-	-	ns
Data set-up time	Tdsu	12	-	-	ns
Data hold time	Tdhd	12	-	-	ns

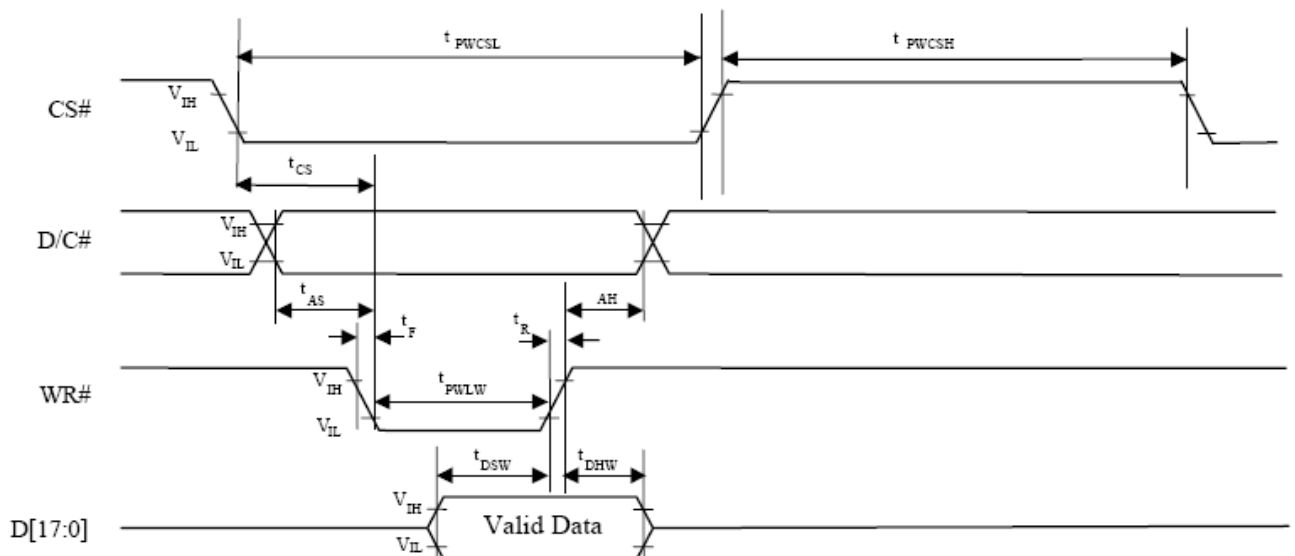


3.3.3 8080-series Interface Timing Condition

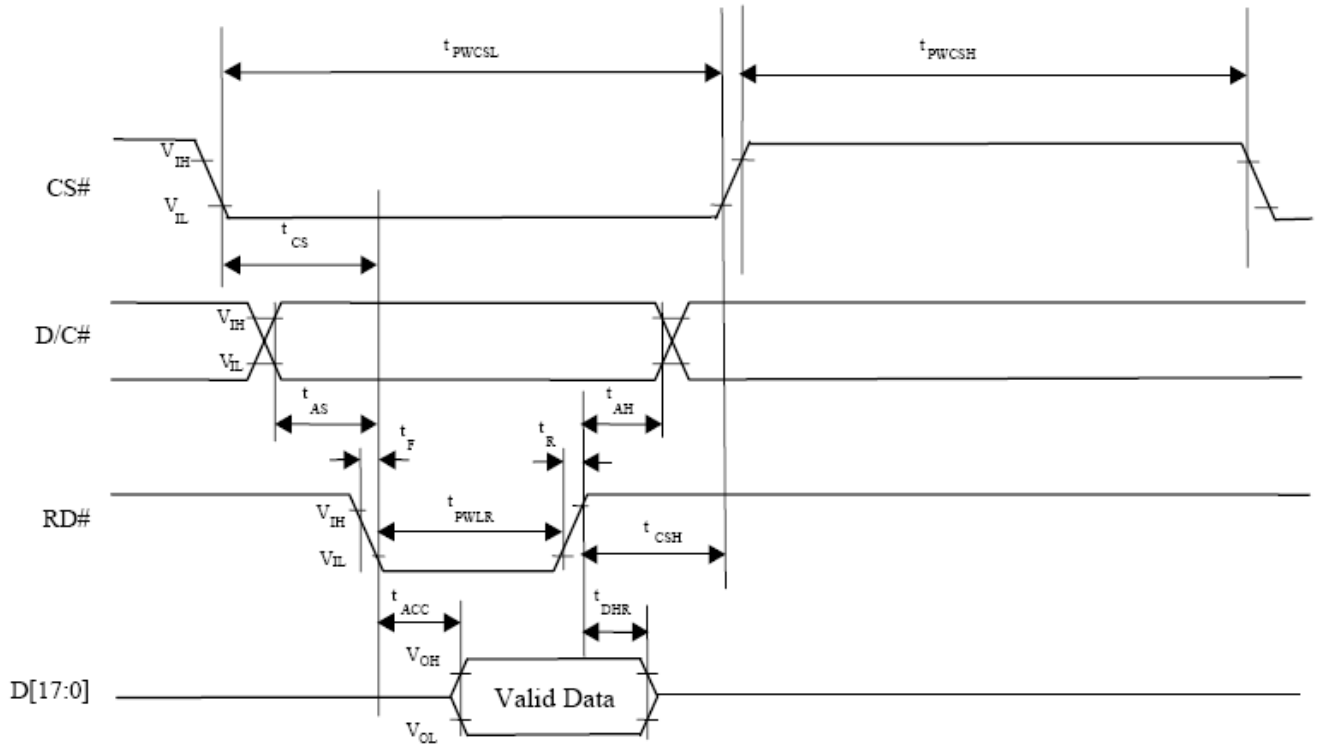
Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
System Clock Frequency	f_{MCLK}	1	-	110	MHz	Note
System Clock Period	t_{MCLK}	$1/f_{MCLK}$	-	-	ns	Note
Control Pulse High Width Write	t_{PWCSL}	13	$1.5 * t_{MCLK}$	-	ns	
Control Pulse High Width Read	t_{PWCSL}	30	$3.5 * t_{MCLK}$	-	ns	
Control Pulse Low Width Write(next write cycle)	t_{PWCSH}	13	$1.5 * t_{MCLK}$	-	ns	
Control Pulse Low Width Write(next read cycle)	t_{PWCSH}	80	$9 * t_{MCLK}$	-	ns	
Control Pulse Low Width Read	t_{PWCSH}	80	$9 * t_{MCLK}$	-	ns	
Address Setup Time	t_{AS}	1	-	-	ns	
Address Hold Time	t_{AH}	2	-	-	ns	
Write Data Setup Time	t_{DSW}	4	-	-	ns	
Write Data Hold Time	t_{DHW}	1	-	-	ns	
Write Low Time	t_{PWLW}	12	-	-	ns	
Read Data Hold Time	t_{DHR}	1	-	-	ns	
Access Time	t_{ACC}	32	-	-	ns	
Read Low Time	t_{PWLR}	36	-	-	ns	
Rise Time	t_R	-	-	0.5	ns	
Fall Time	t_F	-	-	0.5	ns	
Chip select setup time	t_{CS}	2	-	-	ns	
Chip select hold time to read signal	t_{CSH}	3	-	-	ns	

Note : System Clock Denotes external input clock(PLL-bypass) or internal generated clock(PLL-enabled)
 Reference input clock=10MHz.
 About Command setting , Please refer to SSD1963.

3.3.4 Parallel 8080-series Interface Timing Diagram(Write Cycle)



3.3.5 Parallel 8080-series Interface Timing Diagram(Read Cycle)



3.3.6 Mapping for writing an Pixel Data

Interface	Cycle	D[23]	D[22]	D[21]	D[20]	D[19]	D[18]	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
8 bits	1 st																	R7	R6	R5	R4	R3	R2	R1	R0
	2 nd																	G7	G6	G5	G4	G3	G2	G1	G0
	3 rd																	B7	B6	B5	B4	B3	B2	B1	B0

3.4 Backlight Unit

The Backlight system is an edge-lighting type with 7 white LED(Light Emitting Diode)s. The characteristics of 7 white LEDs are shown in the following tables.

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	V _L	(20.3)	(22.4)	(23.8)	V	
LED Current	I _f	-	20	25	mA	
Power Consumption	P _{LED}	-	(448)	(595)	mW	(2)
LED Life Time (25°C)	-	(20000)	-	-	hr	(3)

Note (1) LEDS in 7 series type.

(2) Where I_f = 20mA, V_L = 22.4, P_{LED} = V_L × I_f

(3) The environmental conducted under ambient air flow ,at Ta=25±2°C,60%RH±5%

4. Optical Characteristics

4.1 Optical characteristic of the LCD

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state.

Measuring equipment: BM-7A

(Ta=25±2°C , VCC =3.3V, If=20mA)

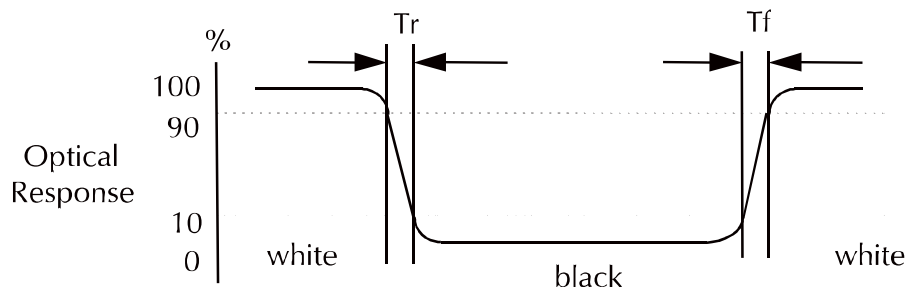
Item	Symbol	Condition	Min	Type	Max	Unit	Note
Brightness	--	--	(400)	(500)	--	cd/m ²	--
Response time	T _R	θ=0°	--	10	15	ms	--
	T _F		--	20	30	ms	
Contrast ratio	CR	At optimized viewing angle	(250)	(350)	--	--	--
Color Chromaticity	Red	R _X	(0.57)	(0.62)	(0.67)	--	--
		R _Y	(0.29)	(0.34)	(0.39)		
	Green	G _X	(0.29)	(0.34)	(0.39)	--	
		G _Y	(0.52)	(0.57)	(0.62)		
	Blue	B _X	(0.09)	(0.14)	(0.19)	--	
		B _Y	(0.05)	(0.10)	(0.15)		
	White	W _X	(0.27)	(0.32)	(0.37)	--	
		W _Y	(0.29)	(0.34)	(0.39)		
Viewing Angle (6H)	Hor.	θ _R	50	(65)		Degree	--
		θ _L	50	(65)			
	Ver.	θ _U	40	(50)			
		θ _D	50	(60)			

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

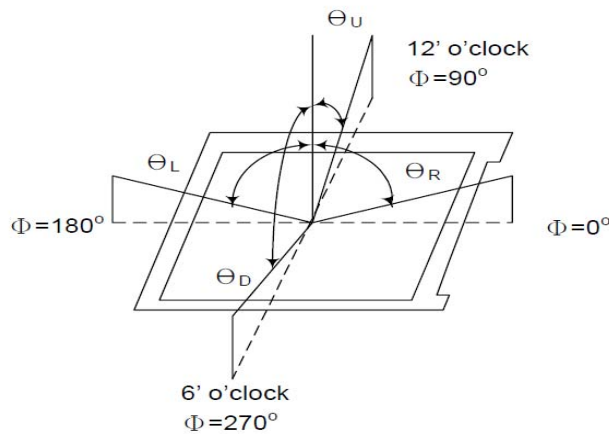


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type
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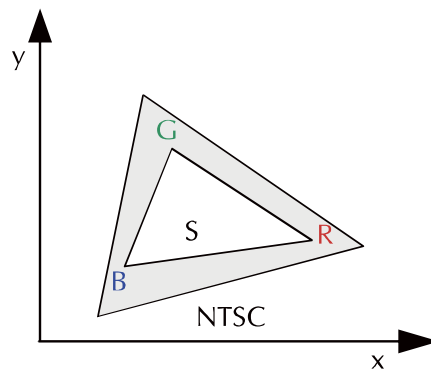
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}}$$

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



5. I/O Terminal

5.1 Pin Assignment

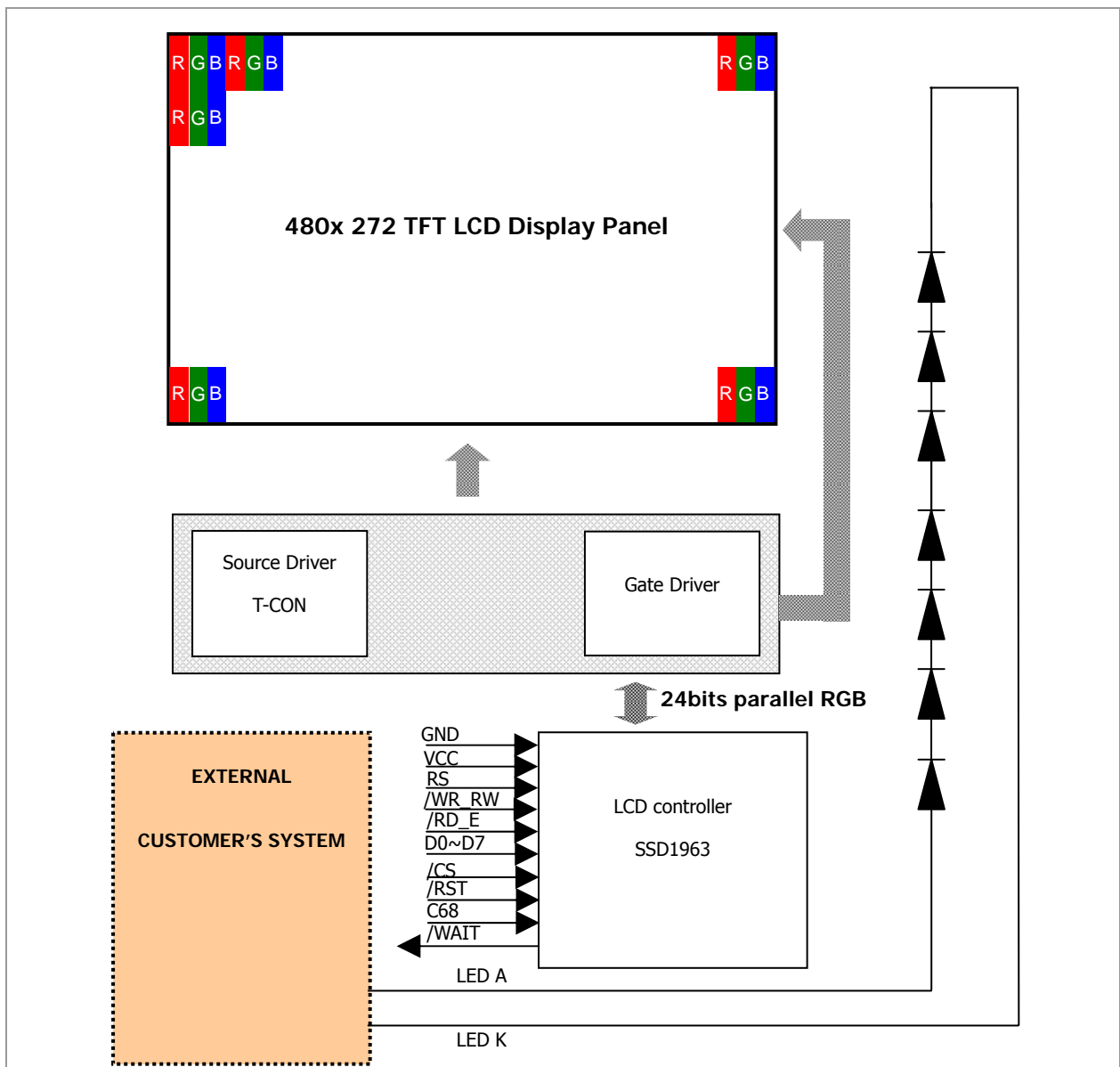
Pin No.	Symbol	I/O	Function	Remark
1	VCC	P	Power supply	
2	VCC	P	Power supply	
3	GND	P	GND	
4	GND	P	GND	
5	/RST	I	Reset signal	
6	NC	-	No connect	
7	/WAIT	O	Tearing effect	
8	C68	I	MCU interface configuration 1: 8080 Interface	
9	/CS	I	Chip select	
10	RS	I	Data/Command select	
11	/RD_E	I	8080 mode: RD# (read strobe signal)	
12	/WR_RW	I	8080 mode: WR# (write strobe signal)	
13	GND	P	GND	
14	DB0	IO	Data bus 0	(1)
15	DB1	IO	Data bus 1	(1)
16	DB2	IO	Data bus 2	(1)
17	DB3	IO	Data bus 3	(1)
18	DB4	IO	Data bus 4	(1)
19	DB5	IO	Data bus 5	(1)
20	DB6	IO	Data bus 6	(1)
21	DB7	IO	Data bus 7	(1)
22	NC	-	No connect	(1)
23	NC	-	No connect	(1)
24	NC	-	No connect	(1)
25	NC	-	No connect	(1)
26	NC	-	No connect	(1)
27	NC	-	No connect	(1)
28	NC	-	No connect	(1)
29	NC	-	No connect	(1)
30	GND	P	GND	

31	NC	-	No connect	
32	NC	-	No connect	
33	GND	P	GND	
34	GND	P	GND	
35	NC	-	No connect	
36	NC	-	No connect	
37	NC	-	No connect	
38	NC	-	No connect	
39	LED A	P	Backlight Anode	
40	LED K	P	Backlight Cathode	

NOTE:

1. DATA Pins not used should be floating

5.2 Block Diagram



5.3 Basic Display Color and Gray Scale

	Color & Gray Scale	Data Signal																							
		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 Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(0)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(0)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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	
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Red(31)	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	Red(62)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(63)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Green(31)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Green(62)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
	Green(63)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Blue(31)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16.7M-color display can be achieved on the screen.

6. Reliability Condition

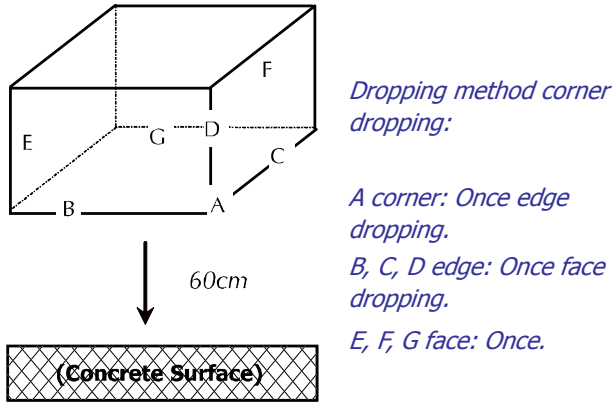
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

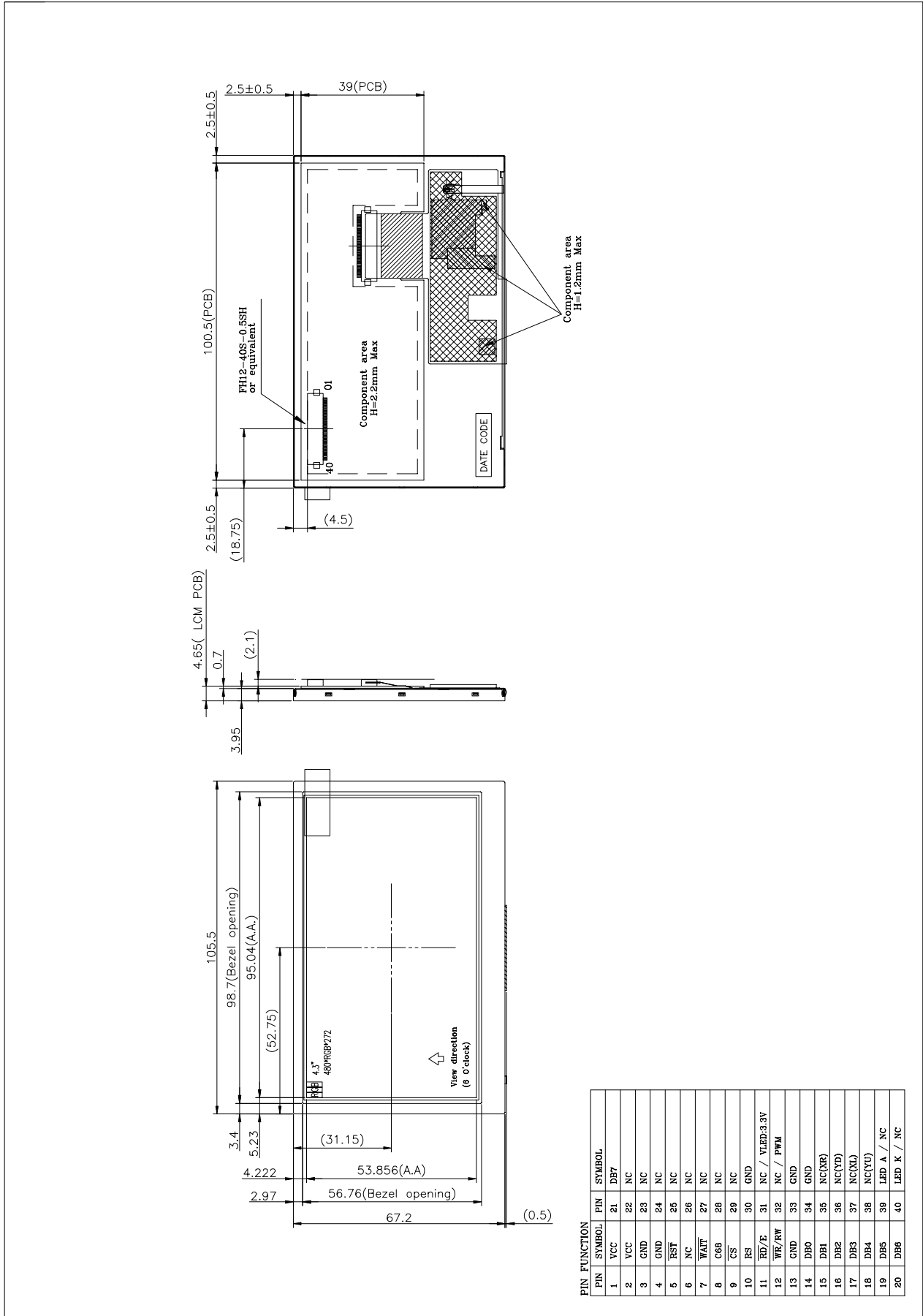
Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state).	-
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state).	-
3	High Temperature Storage	80°C±2°C, 240hrs.	-
4	Low Temperature Storage	-30°C±2°C, 240hrs.	-
5	High Temperature and High Humidity Operation Test	50°C±2°C, 90%, 240hrs.	-
6	Vibration Test	Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	-
7.	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  <i>Dropping method corner dropping:</i> <i>A corner: Once edge dropping.</i> <i>B, C, D edge: Once face dropping.</i> <i>E, F, G face: Once.</i>	-

7. Dimensional Outlines



PIN	SYMBOL	PIN	SYMBOL
1	VCC	21	DB7
2	VCC	22	NC
3	GND	23	NC
4	GND	24	NC
5	RST	25	NC
6	NC	26	NC
7	WAIT	27	NC
8	CB8	28	NC
9	CS	29	NC
10	RS	30	GND
11	RD/TE	31	NC / VLED.3.3V
12	WE/RW	32	NC / PWM
13	GND	33	GND
14	DB0	34	GND
15	DB1	35	NC(XR)
16	DB2	36	NC(YD)
17	DB3	37	NC(XL)
18	DB4	38	NC(YU)
19	DB5	39	LED A / NC
20	DB6	40	LED K / NC