Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 320240N TMH-PW-N (A-TOUCH)

3,5“ TFT + Touch

Product Specification **Ver.: 3**

21.01.2016

Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	04.09.2014		Preliminary
1	04.09.2014		First issue
2	25.03.2015		Correct Interface
2.1.2	16.07.2015		Modify Reliability
3	21.01.2016		Modify Static electricity test

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1. Summary

This technical specification applies to 3.45’ color TFT-LCD panel. The 3.45’ color TFT-LCD panel is designed for camcorder, digital camera application and other electronic products which require high quality flat panel displays. This module follows RoHS.

2. General Specifications

- Size: 3.5 inch
- Dot Matrix: 320 x RGB x 240
- Module dimension: 76.90 x 63.9 x 4.37 mm
- Active area: 70.08 x 52.56 mm
- Dot pitch: 0.073 x 0.219 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Backlight Type: LED , Normally White
- With /Without TP: With RTP
- Surface TFT: Anti-Glare

*Color tone slight changed by temperature and driving voltage.

3.Interface

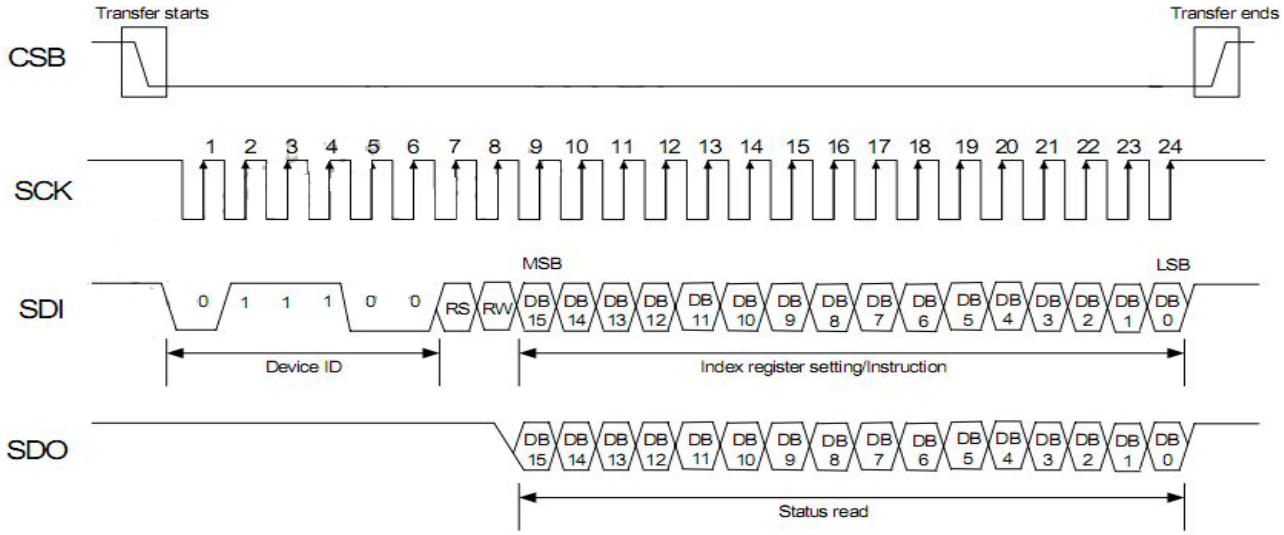
3.1. LCM PIN Definition

Pin	Symbol	Function	Remark
1	**LED-**	Power for LED backlight cathode	
2	**LED-**	Power for LED backlight cathode	
3	**LED+**	Power for LED backlight anode	
4	**LED+**	Power for LED backlight anode	
5	**YU**	Bottom electrode	
6	**XL**	Left electrode	
7	**NC**	No connect	
8	**/RESET**	Hardware reset	
9	**CS**	Chip select pin of serial interface	
10	**SPCLK**	Clock pin of serial interface	
11	**SPDAT**	Data input pin in serial mode	
12	**B0**	Data bus	
13	**B1**	Data bus	
14	**B2**	Data bus	
15	**B3**	Data bus	
16	**B4**	Data bus	
17	**B5**	Data bus	
18	**B6**	Data bus	
19	**B7**	Data bus	
20	**G0**	Data bus	
21	**G1**	Data bus	
22	**G2**	Data bus	
23	**G3**	Data bus	
24	**G4**	Data bus	
25	**G5**	Data bus	
26	**G6**	Data bus	
27	**G7**	Data bus	
28	**R0**	Data bus	
29	**R1**	Data bus	
30	**R2**	Data bus	
31	**R3**	Data bus	
32	**R4**	Data bus	
33	**R5**	Data bus	
34	**R6**	Data bus	
35	**R7**	Data bus	
36	**HSYNC**	Line synchronization signal	
37	**VSYNC**	Frame synchronization signal	
38	**DCLK**	Dot-clock signal and oscillator source	
39	**NC**	No connect	
40	**NC**	No connect	
41	**VCC**	Power Supply	

42	**VCC**	Power Supply	
43	**YD**	Right electrode	
44	**XR**	Top electrode	
45	**NC**	No connect	
46	**NC**	No connect	
47	**NC**	No connect	
48	**NC**	No connect	
49	**NC**	No connect	
50	**NC**	No connect	
51	**NC**	No connect	
52	**DE**	Display enable pin from controller. Internal pull high Connect to VDDIO or floating if not used	
53	**DGND**	System ground pin of the IC. Connect to system ground.	
54	**AVSS**	Grounding for analog circuit. Connect to system ground	

3.2. Serial Peripheral Interface(SPI)

The SPI is available through the chip select line (CSB), serial transfer clock line (SCK), serial data input (SDI), and serial data output (SDO).
The Driver IC recognizes the start of data transfer at the falling edge of CSB input to initiate the transfer of start byte. It recognizes the end of data transfer at the rising edge of CSB input. The Driver IC is selected when the 6-bit chip address in the start byte transferred from the transmission device and the 6-bit device identification code assigned to the Driver IC are compared and both 6-bit data correspond. The identification code must be 011100(Primary SPI Register) or 011101(Secondary SPI Register). Two different chip addresses must be assigned to the Driver IC because the seventh bit of the start byte is assigned to a register select bit (RS). When RS = 0, index register write or status read is executed. When the RS=1, instruction write. The eighth bit of the start byte is to specify read or write (R/W bit). The data are received when the R/W bit is 0, and are transmitted when the R/W bit is 1.
After receiving the start byte, the Driver IC starts to transmit or receive data by byte.The data transmission adopts a format by which the MSB is first transmitted (9th SCK started). All Driver IC instructions consist of 16 bits and they are executed internally after two bytes are transmitted with the MSB first (IB15 to 0---9th ~24th SCK).
Figure 6 SPI Interface Input Signal Timing


Transfer starts
Transfer ends
CSB
SCK
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
SDI
MSB
LSB
0 1 1 1 0 0 RS RW DB15 DB14 DB13 DB12 DB11 DB10 DB9 DB8 DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
Device ID
Index register setting/Instruction
SDO
DB15 DB14 DB13 DB12 DB11 DB10 DB9 DB8 DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
Status read

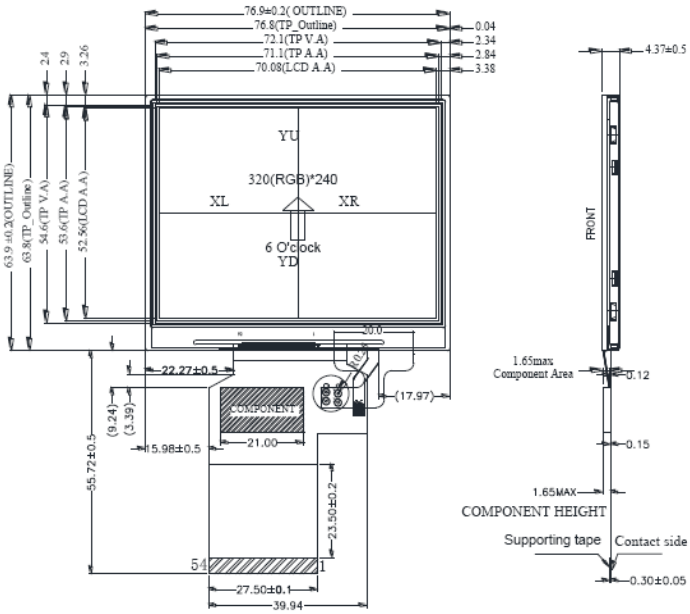
3.3. Recommend Register Setting

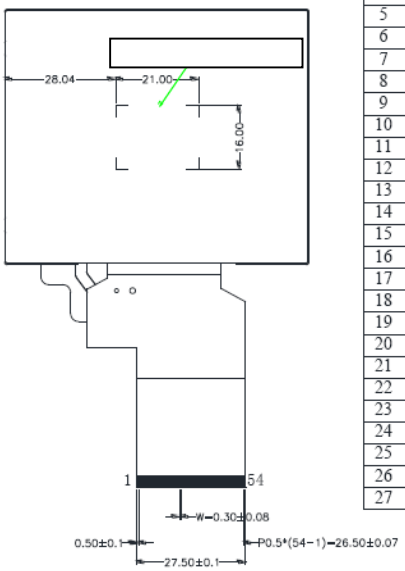
(Reference HX8238-D specification)

```
SPIByteWrite_reg(0x0001);
SPIByteWrite_data(0x6300); //Line Inversion

SPIByteWrite_reg(0x0002);
SPIByteWrite_data(0x0200);

SPIByteWrite_reg(0x0003);
SPIByteWrite_data(0x8286);

SPIByteWrite_reg(0x0004);
SPIByteWrite_data(0x04c7);

SPIByteWrite_reg(0x0005);
SPIByteWrite_data(0xA800);

SPIByteWrite_reg(0x0008);
SPIByteWrite_data(0x06ff);

SPIByteWrite_reg(0x000a);
SPIByteWrite_data(0x4008);

SPIByteWrite_reg(0x000b);
SPIByteWrite_data(0xd400);

SPIByteWrite_reg(0x000d);
SPIByteWrite_data(0x3229);

SPIByteWrite_reg(0x000e);
SPIByteWrite_data(0x1200);

SPIByteWrite_reg(0x000f);
SPIByteWrite_data(0x0000);

SPIByteWrite_reg(0x0016);
SPIByteWrite_data(0x9f80);

SPIByteWrite_reg(0x0017);
SPIByteWrite_data(0x2212);

SPIByteWrite_reg(0x001e);
SPIByteWrite_data(0x00fc);

SPIByteWrite_reg(0x0030);
SPIByteWrite_data(0x0000);
SPIByteWrite_reg(0x0031);
SPIByteWrite_data(0x0707);
```

```
SPIByteWrite_reg(0x0032);
SPIByteWrite_data(0x0206);

SPIByteWrite_reg(0x0033);
SPIByteWrite_data(0x0001);

SPIByteWrite_reg(0x0034);
SPIByteWrite_data(0x0105);
SPIByteWrite_reg(0x0035);
SPIByteWrite_data(0x0000);
SPIByteWrite_reg(0x0036);
SPIByteWrite_data(0x0707);

SPIByteWrite_reg(0x0037);
SPIByteWrite_data(0x0100);

SPIByteWrite_reg(0x003a);
SPIByteWrite_data(0x0502);
SPIByteWrite_reg(0x003b);
SPIByteWrite_data(0x0502);
```

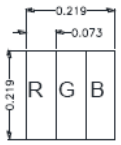
4. Contour Drawing





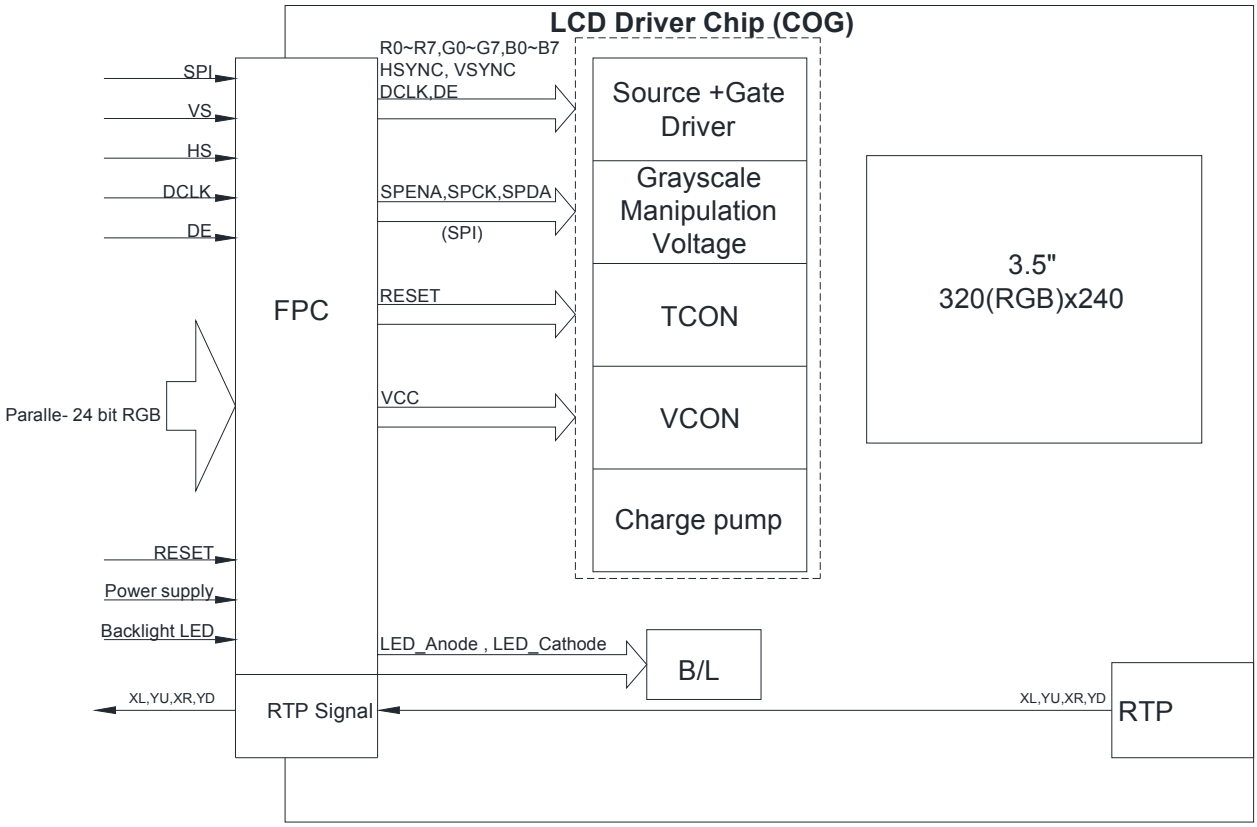
PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	LED-	28	R0
2	LED-	29	R1
3	LED+	30	R2
4	LED+	31	R3
5	YU	32	R4
6	XL	33	R5
7	NC	34	R6
8	/RESET	35	R7
9	CS	36	HSYNC
10	SPCLK	37	VSYNC
11	SPDAT	38	DCLK
12	B0	39	NC
13	B1	40	NC
14	B2	41	VCC
15	B3	42	VCC
16	B4	43	YD
17	B5	44	XR
18	B6	45	NC
19	B7	46	NC
20	G0	47	NC
21	G1	48	NC
22	G2	49	NC
23	G3	50	NC
24	G4	51	NC
25	G5	52	DE
26	G6	53	DGND
27	G7	54	AVSS

The non-specified tolerance of dimension is ±0.3mm.



SCALE 1:100

5. Block Diagram

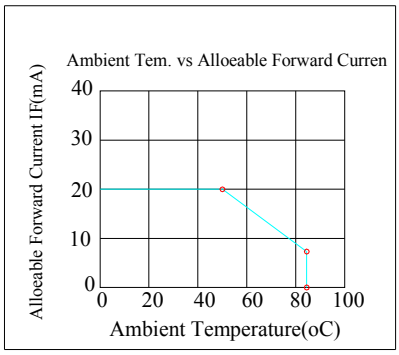


6. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	°C
Storage Temperature	TST	-30	—	+80	°C

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. ≦60°C, 85% RH MAX. Temp. ＞60°C, Absolute humidity shall be less than 85% RH at 60□



7. Electrical Characteristics

7.1. Operating conditions:

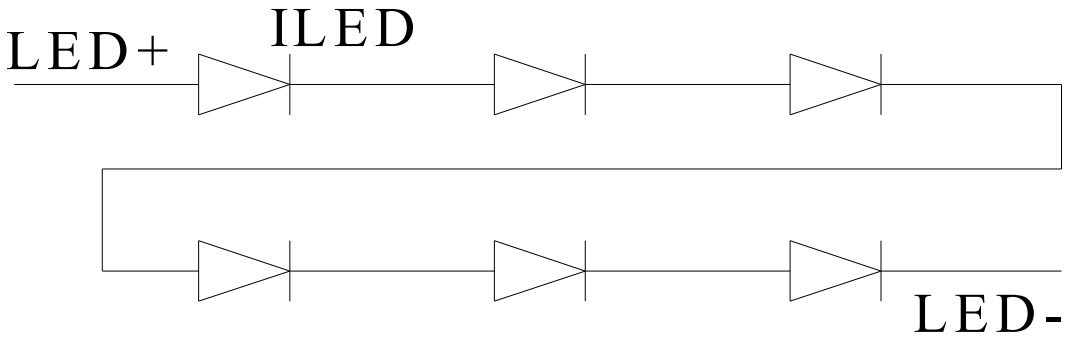
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Supply Voltage For LCM	VCC	—	3.0	3.3	3.6	V	
Supply Current For LCM	ICC	—	—	4	10	mA	Note 1

Note 1 : This value is test for VDD=3.3V , Ta=25°C only

7.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		18	20	25	mA	
LED voltage	LED+	18.0	19.8	21	V	Note 1
LED Life Time		20,000	-	-	Hr	Note 2,3,4

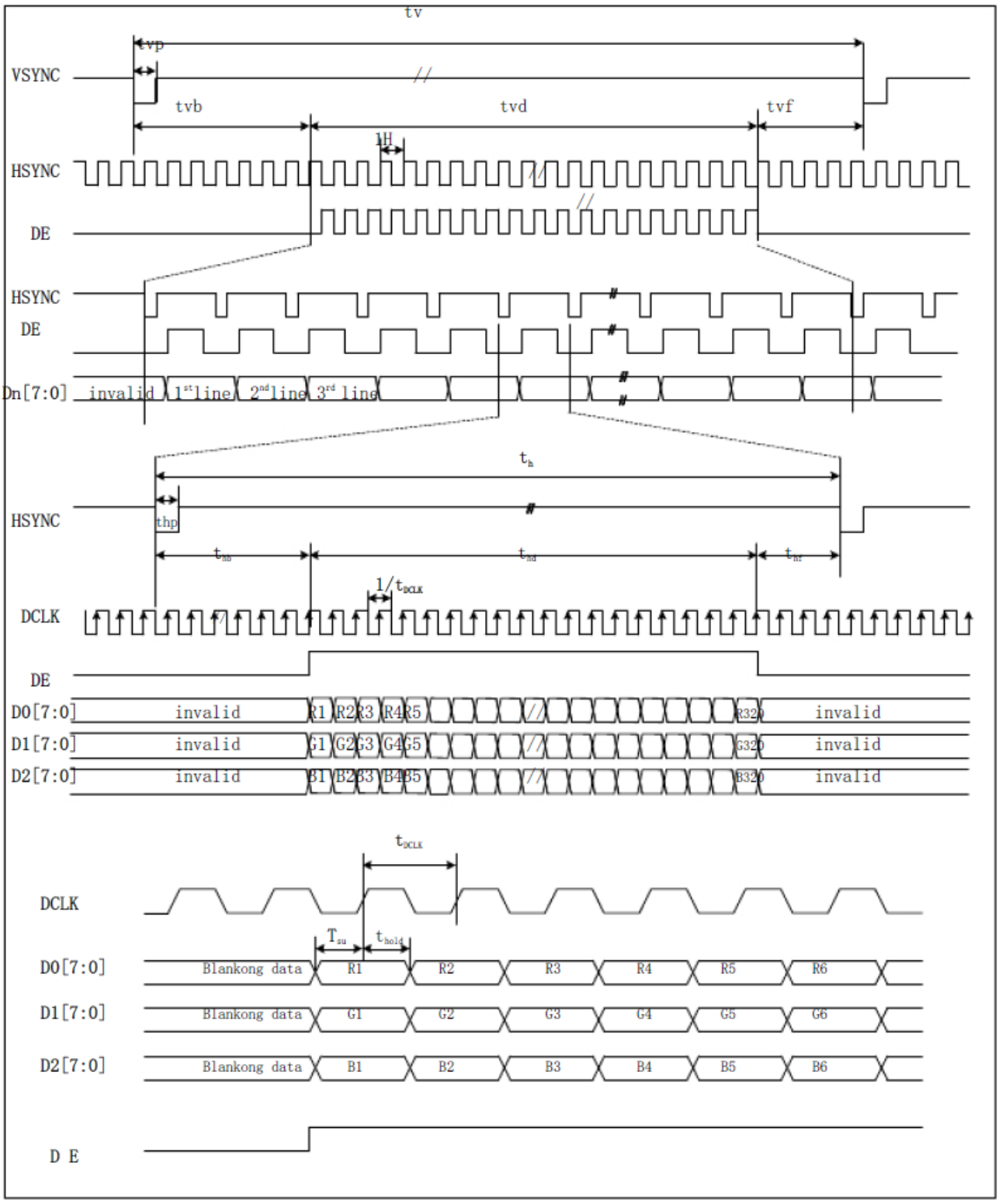
Note 1 : There are 1 Groups LED



Note 2 : Ta = 25°C
Note 3 : Brightness to be decreased to 50% of the initial value
Note 4 : The single LED lamp case

8. Data input Characteristics

Parallel RGB Interface



Parallel RGB Input Signal Timing

Parameter	Symbol	Min.	Typ	Max.	Unit.	Note
DCLK Frequency	1/ tDCLK	—	6.5	10	MHz	
Horizontal Period	th	—	408	—	tDCLK	
Horizontal Display	thd	320	320	320	tDCLK	
Horizontal Back Porch	thb	—	68	—	tDCLK	
Horizontal Front Porch	thf	—	20	—	tDCLK	
Horizontal Pulse Width	thp	1	—	—	tDCLK	
Vertical Period	tv	—		—	th	
Vertical Display Period	tvd	240	240	240	th	
Vertical Back Porch	tvb	—	18	—	th	
Vertical Front Porch	tvf	—	4	—	th	
Vertical Pulse Width	tvp	1	—	—	th	
Data setup time	tsu	12	—	—	ns	
Data hold time	thold	12	—	—	ns	

9. Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr+ Tf	θ=0°、Φ=0°	-	25	40	ms	Note 3,5
Contrast ratio		CR	At optimized viewing angle	300	350	-	-	Note 4,5
Color Chromaticity	White	Wx	θ=0°、Φ=0	0.285	0.305	0.325	-	Note 2,6,7
		Wy		0.314	0.334	0.354	-	-
Viewing angle	Hor.	ΘR	CR≧10	60	70	-	Deg.	Note 1
		ΘL		60	70	-		
	Ver.	ΦT		40	50	-		
		ΦB		60	70	-		
Brightness		-	-	250	300	-	cd/m^2	Center of display

Ta=25±2°C, IL=20mA

Note 1: Definition of viewing angle range

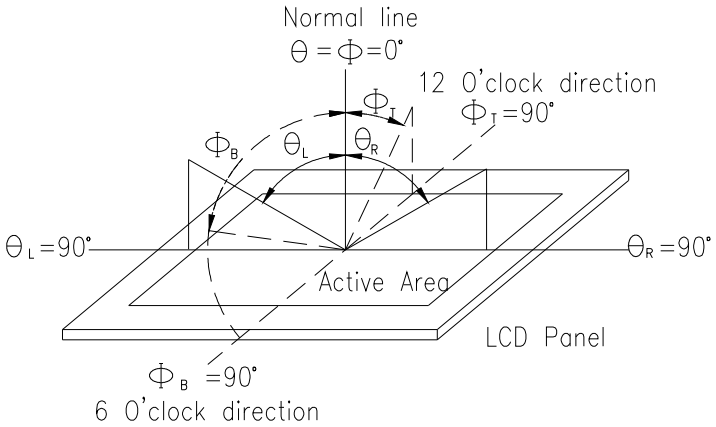


Fig. 10.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

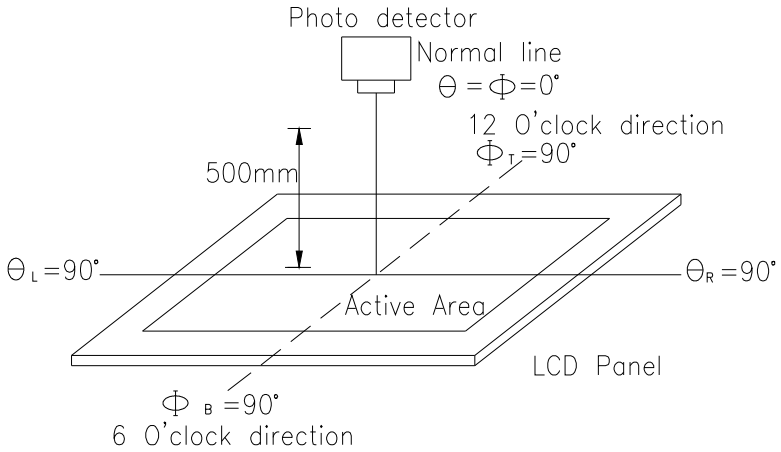
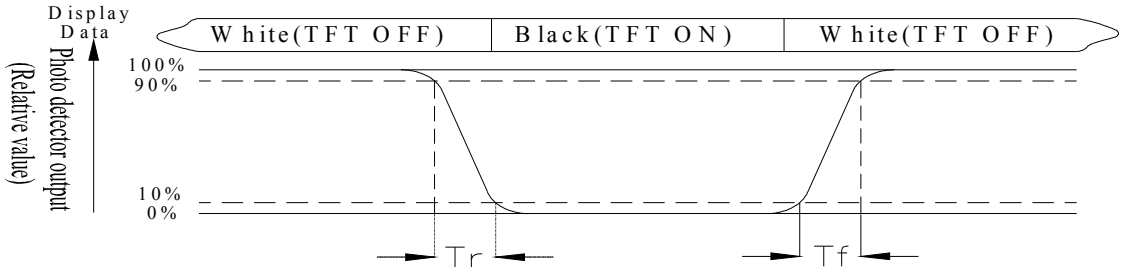


Fig. 10.2. Optical measurement system setup

Note 3: Definition of Response time:
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time, Tr, is the time between photo detector output intensity changed from 90%to 10%. And fall time, Tf, is the time between photo detector output intensity changed from 10%to 90%



Note 4: Definition of contrast ratio:
The contrast ratio is defined as the following expression.

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

Note 5: White Vi = Vi50 ± 1.5V
Black Vi = Vi50 ± 2.0V
"±" means that the analog input signal swings in phase with VCOM signal.
"±" means that the analog input signal swings out of phase with VCOM signal.
The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

10. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

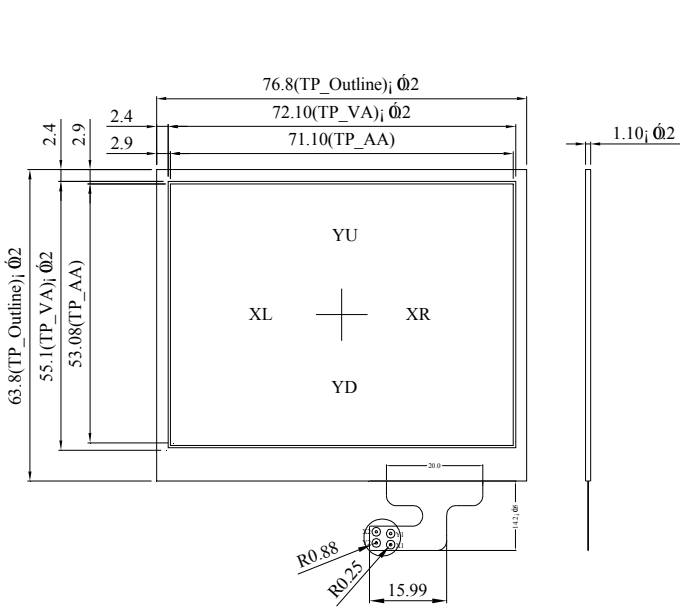
Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 96hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 96hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60□,85%RH max	60°C,85%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20°C 25°C 60°C 30min 5min 30min 1 cycle	-20°C/60°C 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 15mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	——

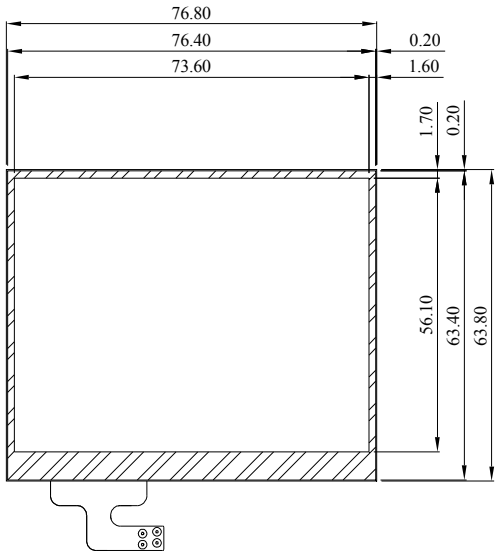
Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

11.Touch Panel Information





PIN OUT	
X2	XR
Y2	YD
X1	XL
Y1	YU

The non-specified tolerance of dimension is ±0.3mm.