

深圳市海量视界电子科技有限公司

PRODUCTION SPECIFICATION

OF LCD MODULE

MODULE NO.: HL040BHD8801ACT

Customer Name:			
Customer Part Number:			
Approved By:		Date:	

Prepared By	Checked By	Approved By

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Revision History

Rev	Issued Date	Description	Page	Editor
1.0	Apr. 17,2024	First release	All	

1 General Specifications

Feature		Specifications
Display Spec.	LCD type	4.0 inch
	Resolution (H*V)	720(RGB) *720
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	IPS/Transmissive/Normally Black
	Viewing Direction	All
	Gray Scale Inversion Direction	--
Mechanical Characteristics	OutlineDimensions (W x H x T) (mm)	84(H) *84(V)*3.2(T)
	Active Area(mm)	71.93 (H)*71.93(V)
	With /Without Touch screen	Without
	Match Connector Type	0.5 Pitch 30 Pin
	Backlight Type	White LED
	Weight (g)	TBD
Electrical Characteristics	Interface	MIPI 4Lane
	Number of color	16.7M
	Driver IC	FL7703NI
	CTP IC	FT6336U

2 Pin Assignment

NO.	PIN NAME	Description
1	LEDA	LED anode
2	LEDK1	LED Cathode
3	LEDK2	LED Cathode
4	VCI	Power Supply 3.3V
5	IOVCC	Power Supply 1.8V
6	RESET	LCM reset signals
7	TE	Tearing effect output
8	PWM	The PWM frequency output for LCD driver control.
9	GND	Ground
10	D0P	DSI-D0+ data signals
11	D0N	DSI-D0- data signals
12	GND	Ground
13	D1P	DSI-D1+ data signals
14	D1N	DSI-D1- data signals
15	GND	Ground
16	CLKP	DSI-Clock+
17	CLKN	DSI-Clock-
18	GND	Ground
19	D2P	DSI-D2+ data signals
20	D2N	DSI-D2- data signals
21	GND	Ground
22	D3P	DSI-D3+ data signals
23	D3N	DSI-D4- data signals
24	GND	Ground
25	TP_INT	Touch Interrupt
26	TP_SDA	Touch IIC Data signal
27	TP_SCL	Touch IIC Clock signal
28	TP_RESET	Touch Reset Signal
29	TP_VCI	Touch Power supply
30	TP_IOVCC	Touch Power supply

3 Absolute Maximum Ratings

GND=0V, Ta= 25°C

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	0.3~3.3	V
Input voltage	V_{in}	$V_{DD}+0.3$	V
Operating temperature	T_{opr}	-20 to 70	°C
Storage temperature	T_{stg}	-30 to 80	°C

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.8	3.0	3.3	V	-
Supply current	I_{DD}	-	-	30	mA	$V_{DD}=3.3V, T_a=25^{\circ}C$
Input voltage	V_{IH}	0.8VDD	-	VDD	V	-
	V_{IL}	0	-	0.2VDD	V	
Input leakage current	I_{IL}	-1.0	-	1.0	μA	$V_{IN}=V_{DD}$ or V_{SS}

Note: Voltage greater than above may damage the module.

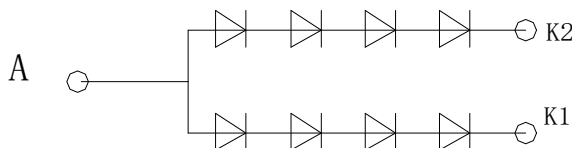
All voltages are specified relative to VSS=0V.

4.2 Driving Backlight

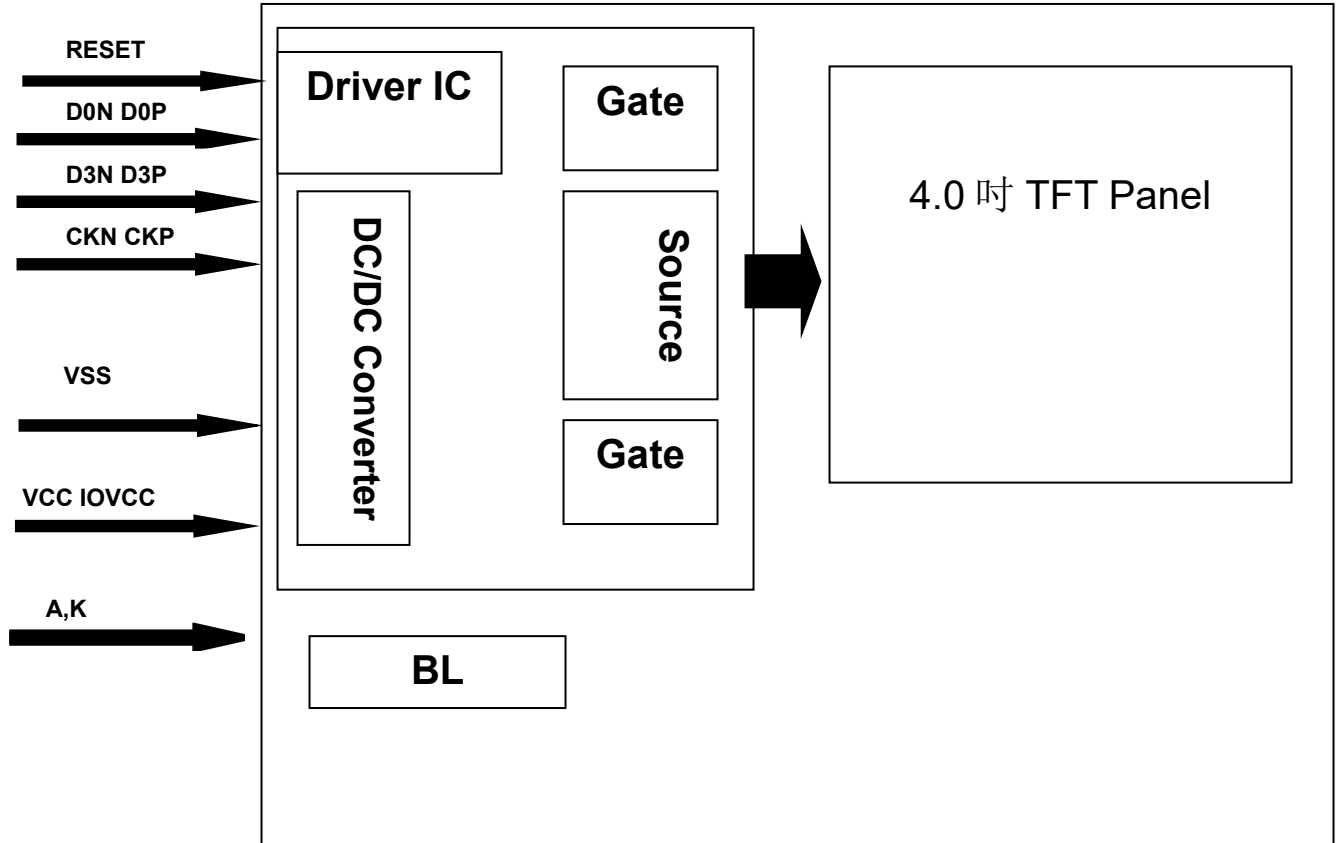
Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	40	-	mA	
Forward Voltage	V_F	-	12.8	-	V	
Connection mode	P	--	4S2P	--		
LED number	/		8		pcs	
LED life time		20000			hours	

Note1: Optical performance should be evaluated at Ta=25°C only .If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



4.3 Block Diagram



5 INTERFACE TIMING

5.1 DSI Interface Timing Characteristics.

High Speed Mode

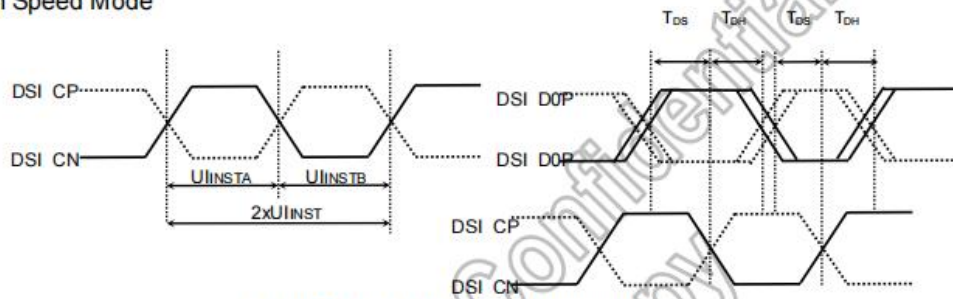
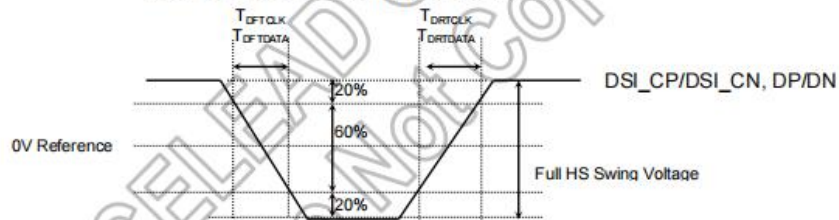


Figure 7-4: DSI clock timing Characteristics



Rising and falling time on clock and data channel

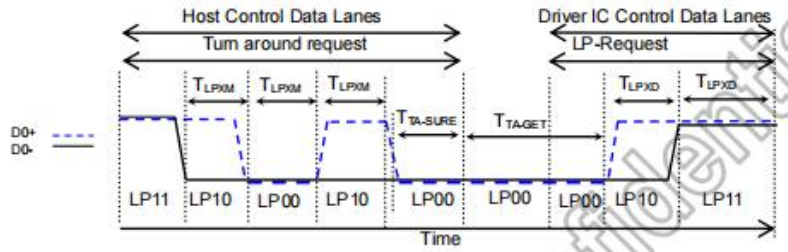
(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, TA = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	2xUINST	4LANE: 3.30 3LANE: 2.85 @ VDDD=1.8V	-	25	ns
	UI instantaneous	UINSTA UINSTB	4LANE: 1.67 3LANE: 1.43 @ VDDD=1.8V	-	12.5	ns
DP/DN	Data to clock setup time	TDS	0.15xUI	-	-	ps
	Data to clock hold time	TDH	0.15xUI	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	TDRCLK	150	-	0.3UI	ps
	Differential fall time for clock	TDFCLK	150	-	0.3UI	ps
DP/DN	Differential rise time for data	TDRDATA	150	-	0.3UI	ps
	Differential fall time for data	TDFDATA	150	-	0.3UI	ps

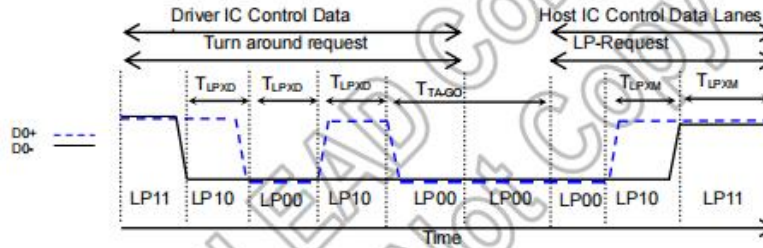
DSI High Speed Mode Characteristics

5.2

Low Power Mode



BTA from HOST to Display Module Timing



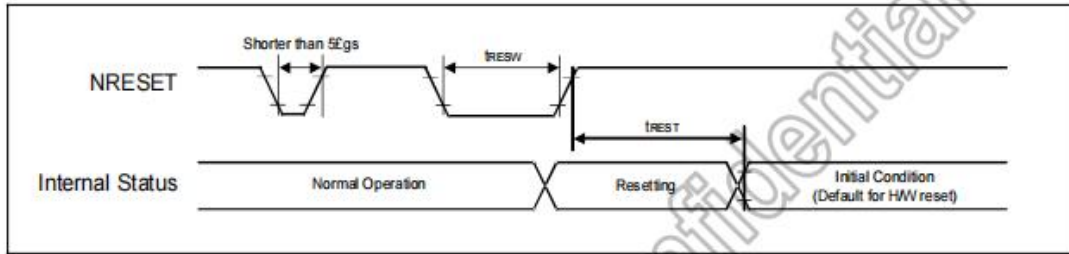
BTA from Display Module Timing to HOST

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T_A = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0M	Length of LP-00/LP01/LP10/LP11 Host → Display module	T _{LPXM}	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	T _{LPXD}	50	-	-	ns
	Time-out before the MPU start driver	T _{TA-SURE}	T _{LPXD}	-	2xT _{LPXD}	ns
	Time to drive LP-00 by display module	T _{TA-GET}	5xT _{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T _{TA-GO}	4xT _{LPXD}	-	-	ns

DSI Low Power Mode Characteristics

Reset input timing



Reset input timing

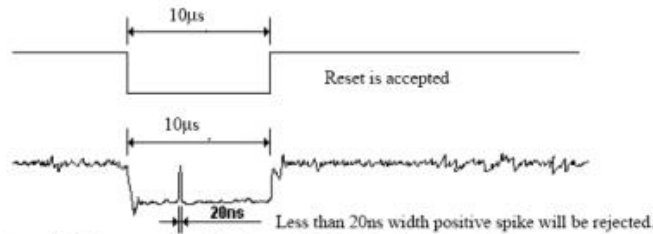
Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	µs
tREST	Reset complete time ⁽²⁾	-	15	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

Reset Input Timing

Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the following table.

NRESET Pulse	Action
Shorter than 5 µs	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which Maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for HW reset.
- (3) During Reset Complete Time, ID and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when there is HW reset complete time (tREST) within 15ms after a rising edge of NRESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown as below:



- (5) It is necessary to wait 15msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

5.2 Power ON/OFF Timing

Power On Timing of External Power IC

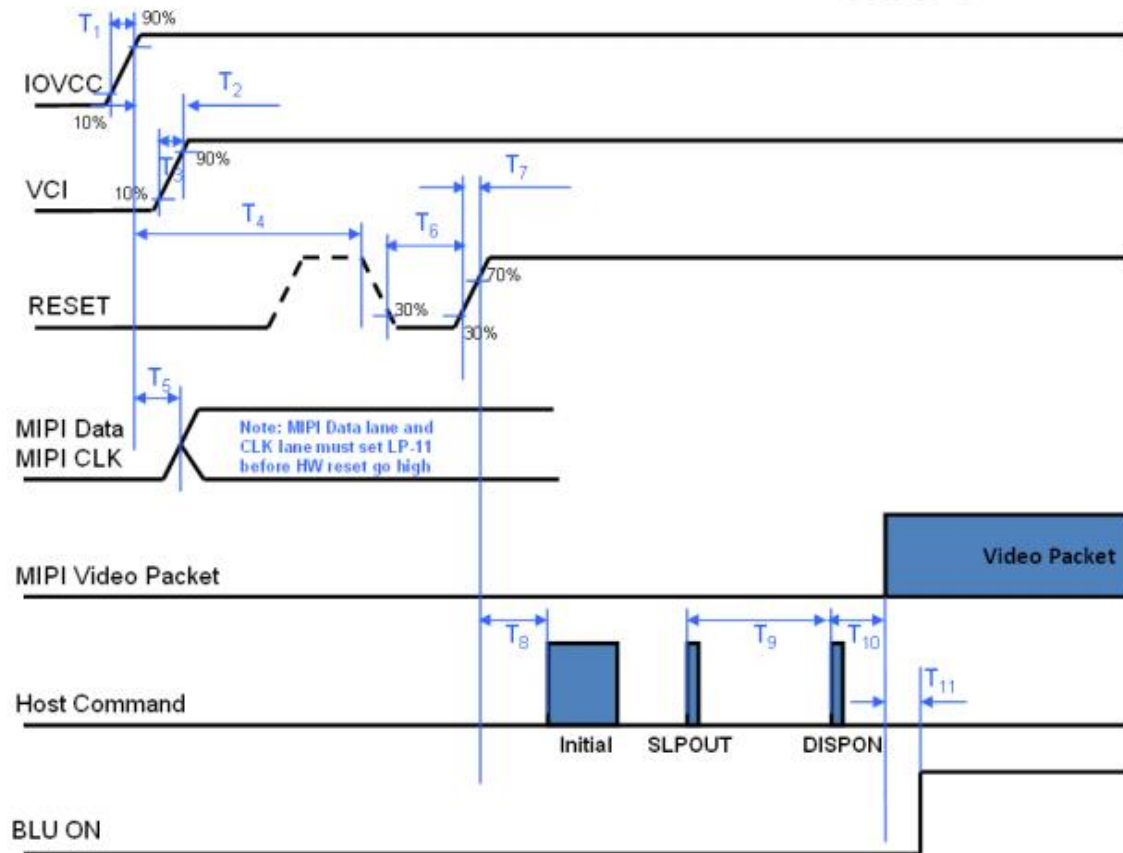


Figure 8-6: DSI Power On Sequence of Power IC Mode

	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	No Limit			ms
T3	0.01	-	10	ms
T4	1	-	-	ms
T5	1	-	-	ms
T6	10	-	-	us
T7	No Limit			ns
T8	15	-	-	ms
T9	120	-	-	ms
T10	No Limit			ms
T11	100	150	-	ms

Table 8-1: DSI Power On Timing of Power IC Mode

Power Off Timing of External Power IC

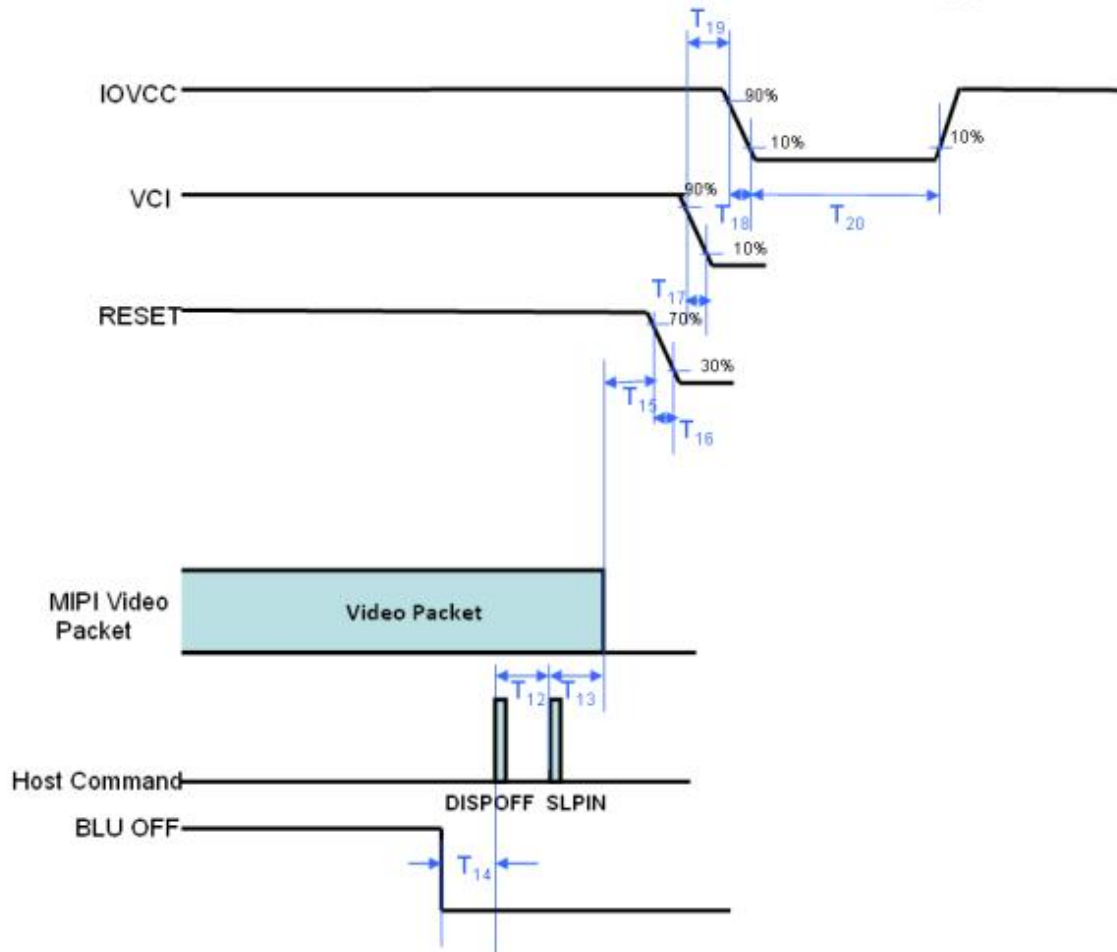
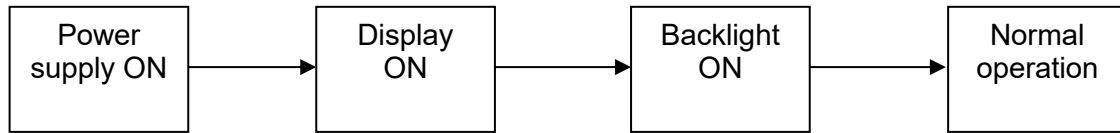


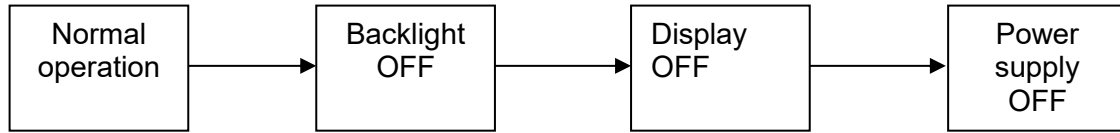
Figure 8-7: DSI Power Off Sequence of Power IC Mode

	Min.	Typ.	Max.	Unit
T12	2	-	-	Frame
T13	2	-	-	Frame
T14	40	100	-	ms
T15	10	-	-	ms
T16	No Limit			ms
T17	No Limit			ms
T18	No Limit			ms
T19	No Limit			ms
T20	100			ms

Table 8-2: DSI Power Off Timing of Power IC Mode



Power ON sequence



Power OFF sequence

TCON (Embedded in Source IC) Input Timing (DCLK, HS, VS, DE)

VCI=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK	Fclk	-	35	-	MHz	
	tclk	-	28	-	ns	
HSD	thd	-	720	-	tclk	
	thpw	-	2	-	tclk	
	thb	-	46	-	tclk	
	thfp	-	44	-	tclk	
VSD	tvd	-	720	-	th	
	tvpw	-	2	-	th	
	tvb	-	18	-	th	
	tvfp	-	16	-	th	

Note: For reference only, it needs to be adjusted according to the actual display effect.

6 Optical Characteristics

Ta=25℃

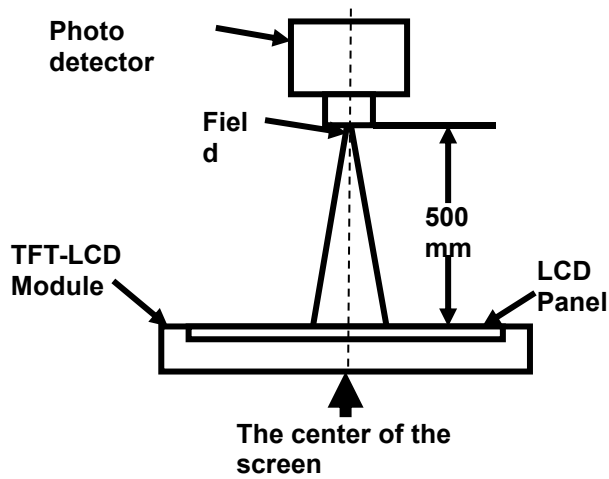
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$		85	-	Degree	Note 2
	θB			85	-		
	θL			85	-		
	θR			85	-		
Contrast Ratio	CR	$\theta=0^\circ$	800	1000	-	-	Note1 Note3
Response Time	T_{ON}	25℃	-	25	35	ms	Note1 Note4
	T_{OFF}						
Uniformity	U	-	-	-	-	%	Note1 Note6
NTSC	-	-	63	68	-	%	Note 5
Luminance	L		-	260	-	cd/m ²	Note1 Note7

Test Conditions: $V_F=12.8\text{ V}$, $I_F=40\text{mA}$, the ambient temperature is 25℃.

1. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

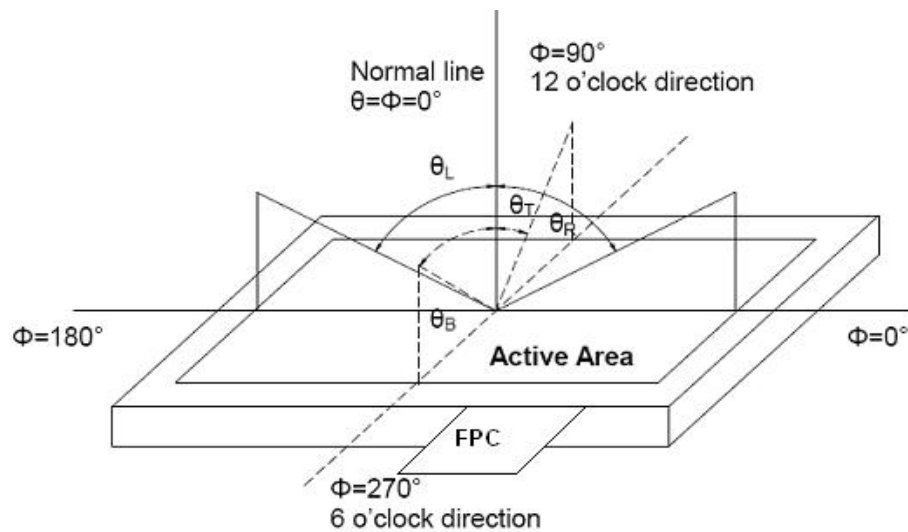


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

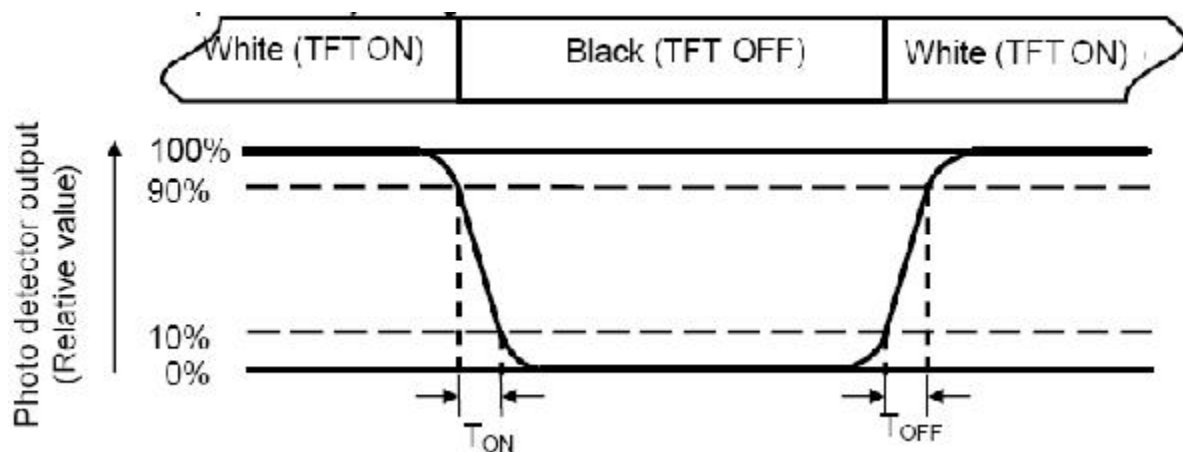
“White state “: The state is that the LCD should be driven by V_{white}.

“Black state”: The state is that the LCD should be driven by V_{black}.

V_{white}: To be determined V_{black}: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

**Note 5: Definition of color chromaticity (CIE1931)**

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L-----Active area length W----- Active area width

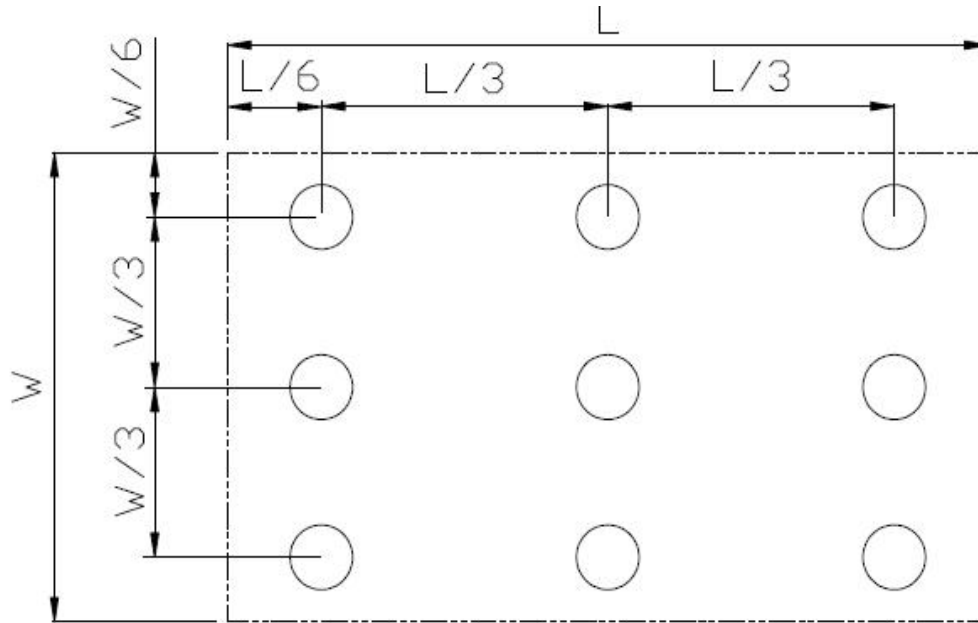


Fig. 2 Definition of uniformity

L_{max} : The measured maximum luminance of all measurement position.

L_{min} : The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

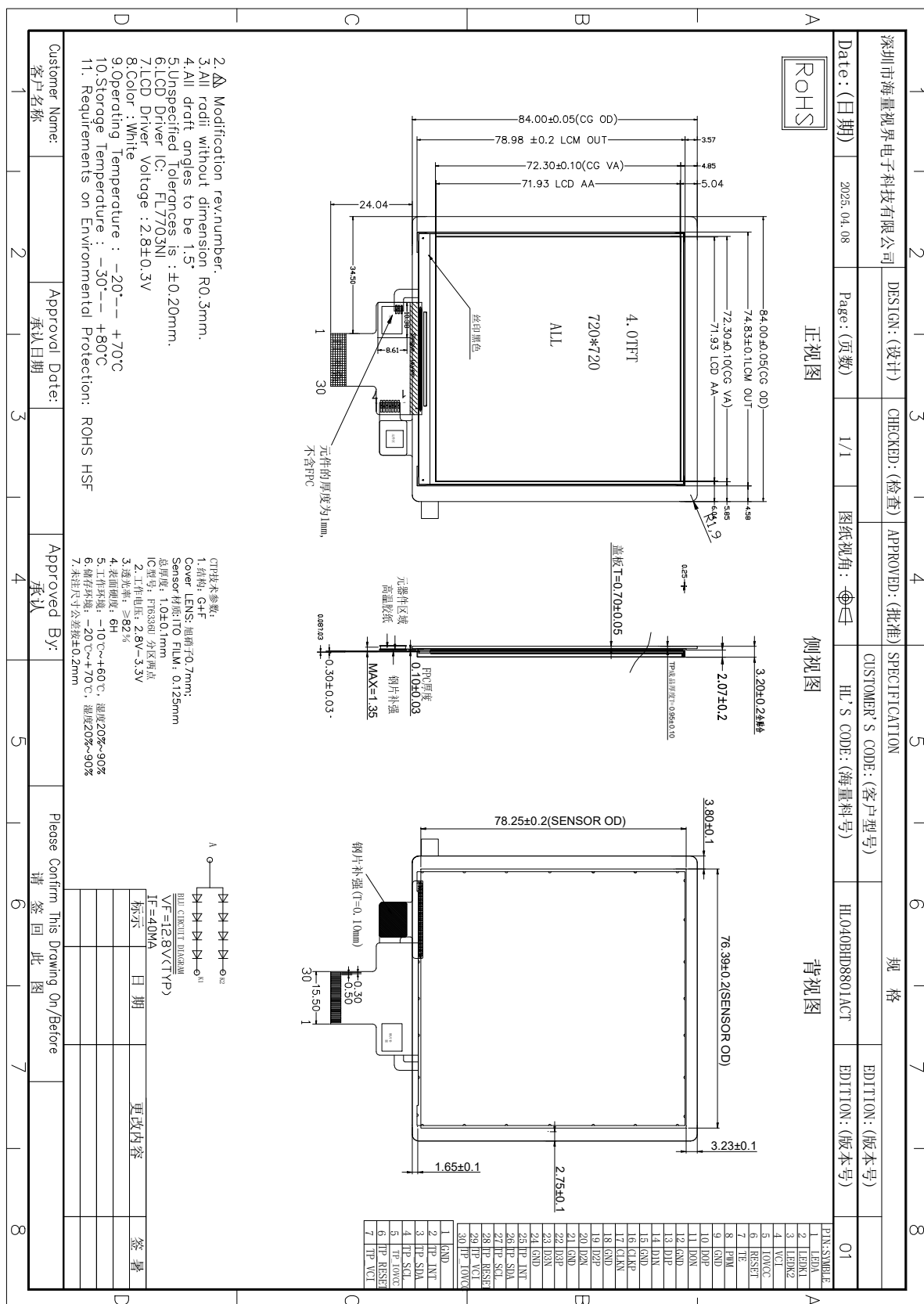
7 Environmental / Reliability Test

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	72	No abnormalities in functions and appearance
High temp. Operating	70°C	72	
Low temp. Storage	-30°C	72	
Low temp. Operating	-20°C	72	
Humidity	40°C/ 90%RH	72	
Thermal Shock(Non-operation)	-20°C ← 25°C →70°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 1~10pcs.
- 3.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

8 Mechanical Drawing



9 Precautions For Use of LCD Modules

9.1 Handling Precautions

9.1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.1.2 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.

9.1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, 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

9.1.1.6 Do not attempt to disassemble the LCD Module.

9.1.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.1.9 Be sure to ground the body when handling the LCD Modules.

9.1.1.10 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.1.11 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.1.12 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.1.1.13 Storage precautions

9.1.1.14 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.1.1.15 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

9.1.1.16 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.2 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.