深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TST050FHSH-47

Version: V1.0

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2021-01-18	Initial Release	

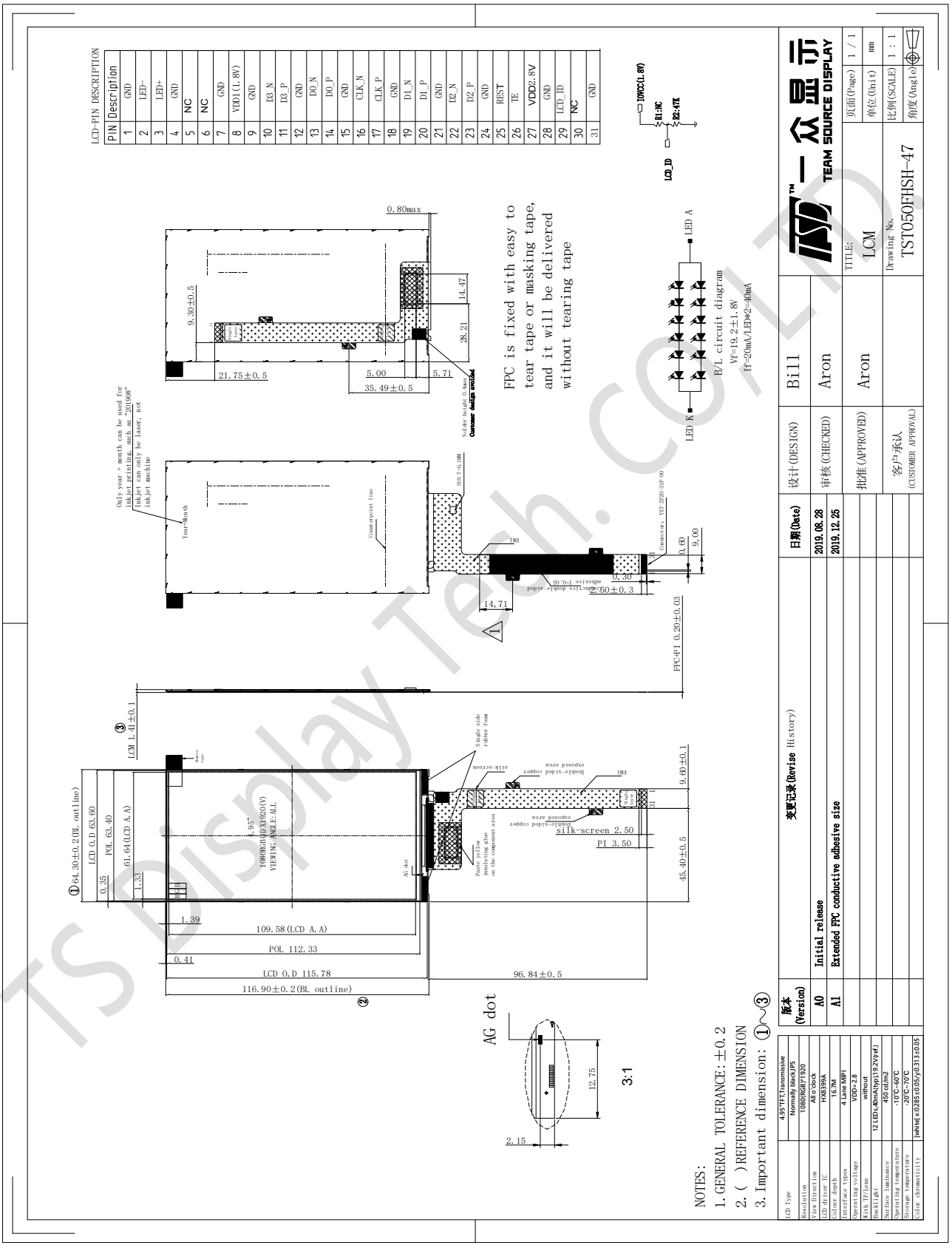
CONTENTS

1 General Characteristics

ITEM	Specification	Unit
LCD Type	LTPSTFT,Transmissive,Normally black,IPS	-
LCD Size	4.95	inch
Resolution (W x H)	1080 x (RGB) × 1920	pixel
LCM (W × H × D)	64.3(W) x 116.9(H) x 1.41(D)	mm
Active Area (W × H)	61.88 (W) x 110.02 (H)	mm
Dot Pitch (W × H)	0.0191 x 0.0573	mm
Viewing Direction	ALL o'clock	-
Gray Scale Inversion Direction	ALL o'clock	-
Viewing Angle	Top:80,Bottom:80; Left/ Right:80	deg.
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	12 LEDs	-
Surface Luminance	450	cd/m2
Surface Treatment	-	-
Polarizer	-	-
Driver IC	HX8399-A	-
Interface Type	MIPI	-
Input Voltage	2.8	V
With/Without TP	Without	-
Weight	TBD	g

Note 1: RoHS compliant
Note 2: LCM weight tolerance: ± 5%.

2 Product drawings

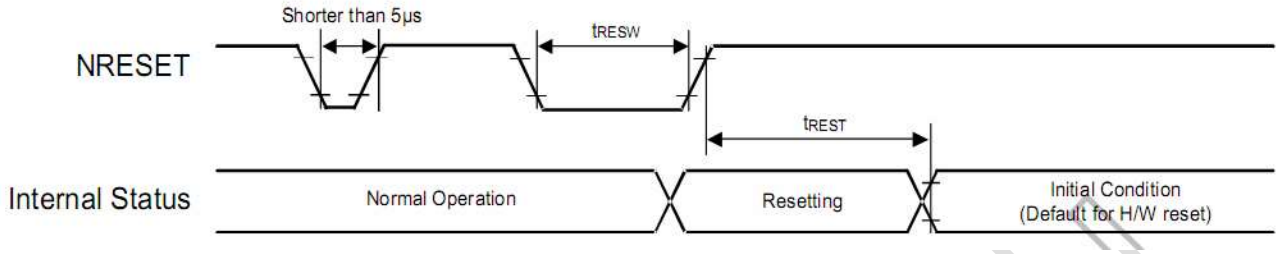


3 Interface description

PIN NO.	Symbol	description
1	GND	System Ground. (0V)
2	LED-	Backlight K Cathode input pin.
3	LED+	Backlight A Aothod input pin.
4	GND	System Ground. (0V)
5	NC	No connect
6	NC	No connect
7	GND	System Ground. (0V)
8	VDDI(1.8V)	Voltage input pin for logic I/O +1.8V
9	GND	System Ground. (0V)
10	D3_N	MIPI data cathode input pin
11	D3_P	MIPI data aothod input pin
12	GND	System Ground. (0V)
13	D0_N	MIPI data cathode input pin
14	D0_P	MIPI data aothod input pin
15	GND	System Ground. (0V)
16	CLK_N	MIPI clock cathode input pin
17	CLK_P	MIPI clock aothod input pin
18	GND	System Ground. (0V)
19	D1_N	MIPI data cathode input pin
20	D1_P	MIPI data aothod input pin
21	GND	System Ground. (0V)
22	D2_N	MIPI data cathode input pin
23	D2_P	MIPI data aothod input pin
24	GND	System Ground. (0V)
25	REST	Reset input signal
26	TE	Tearing Effect output signal
27	VDD2.8V	Power supply +2.8V
28	GND	System Ground. (0V)
29	LCD_ID	47K resistor connect Ground
30	NC	No connect
31	GND	System Ground. (0V)

4 LCM Interface Timing

4.1 Reset Timing



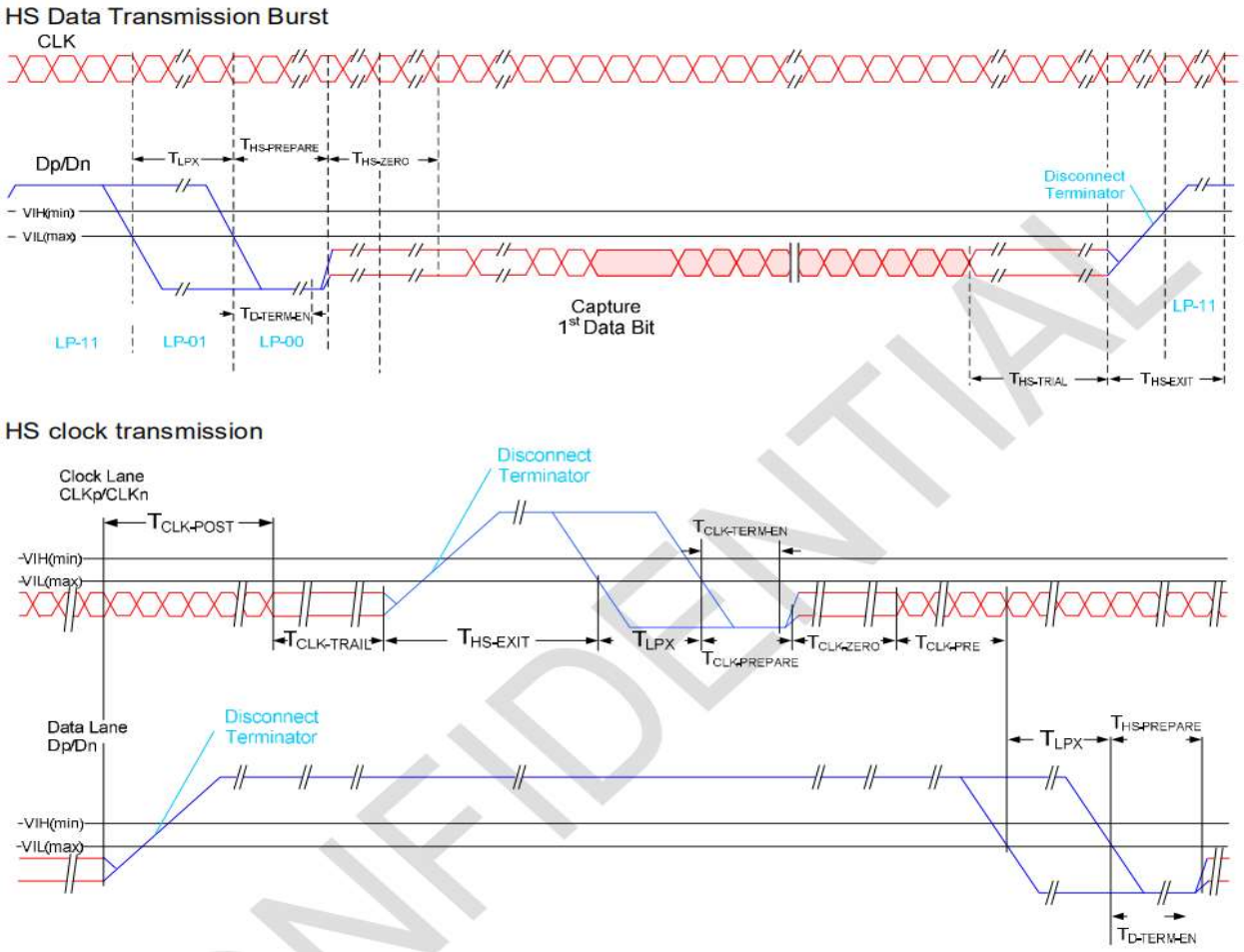
Reset input timing:

IOVCC=1.65 to 3.6V, VCI=2.5 to 3.6V, AGND=DGND=0V, Ta=-40 to 85℃

Signal	Symbol	Parameter	Min	Max	Unit
NRESET	tRESW	Reset low pulse width	15	-	us
	tREST	Reset complete time	5 (note 1)	5	ms
			120(note 2)	120	ms

Note: (1) When reset applied during SLPIN mode;
(2) When reset applied during SLPOUT mode.

4.2 DSI Timing Characteristics

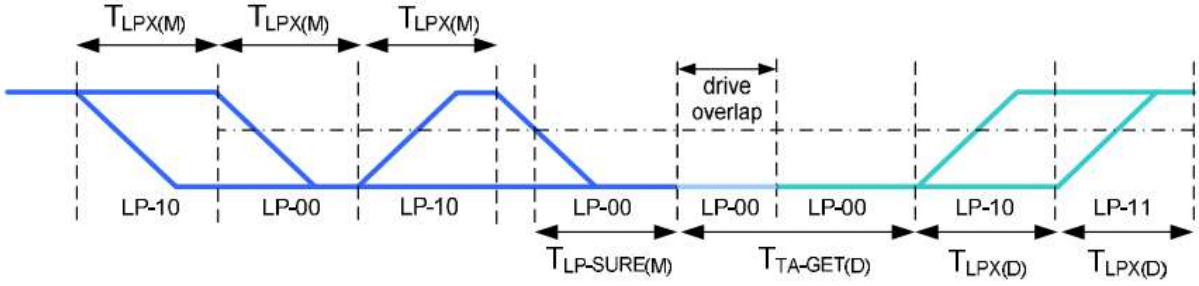


Timing Parameters:

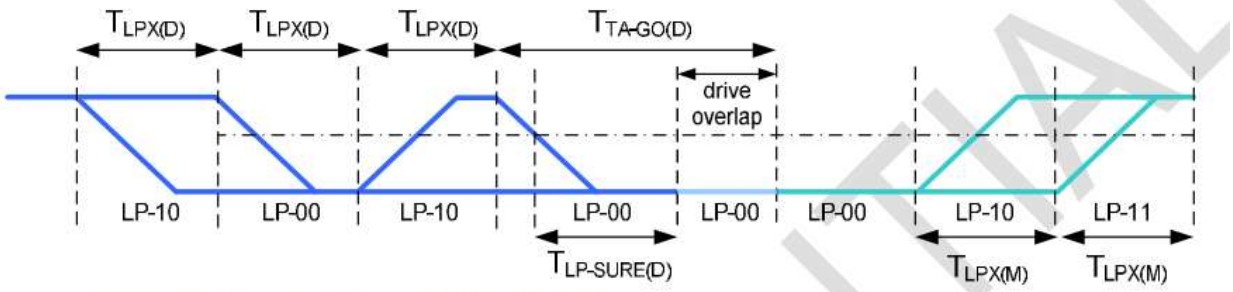
Parameter	Description	Min	Typ	Max	Unit
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$.	60ns + 52*UI			ns
$T_{CLK-TRAIL}$	Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.	60			ns
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	100/800 *Note			ns
$T_{CLK-TERM-EN}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		38	ns
$T_{CLK-PREPARE}$	Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	38		95	ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8			UI
$T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$	$T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300			ns
$T_{D-TERM-EN}$	Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		35 ns +4*UI	
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission	40ns + 4*UI		85 ns + 6*UI	ns
$T_{HS-PREPARE}$ + $T_{HS-ZERO}$	$T_{HS-PREPARE}$ + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.	145ns + 10*UI			ns
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	60ns + 4*UI			ns

Note: 100ns if UI period < 2ns (MIPI frequency > 500Mbps) (UI_{INST} < 2 ns). 800ns if UI period > 2ns.

Turnaround Procedure



Bus turnaround (BAT) from MPU to display module timing



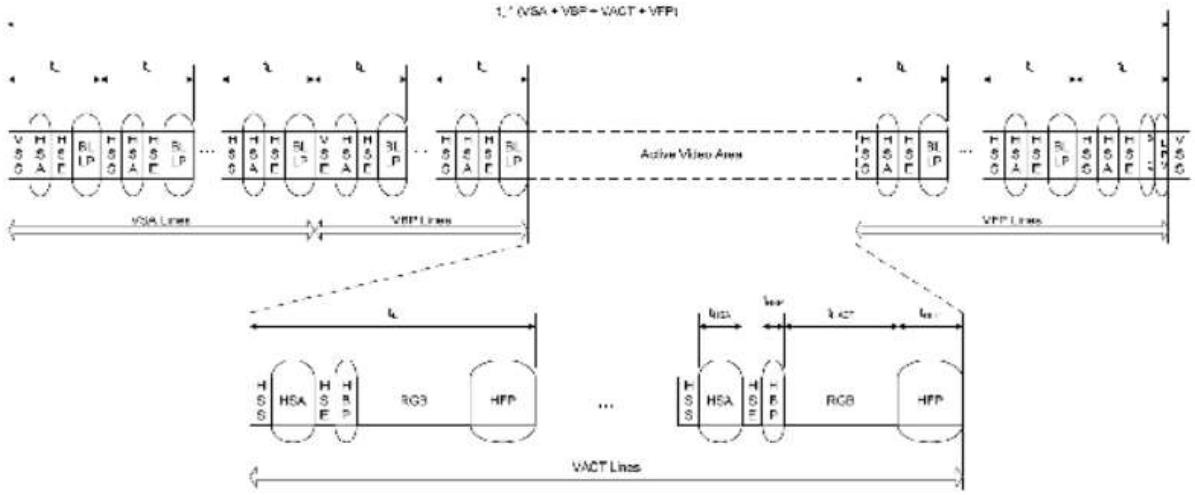
Bus turnaround (BAT) from display module to MPU timing

Low Power Mode :

Parameter	Description	Min	Typ	Max	Unit	Notes
$T_{LPX(M)}$	Transmitted length of any Low-Power state period of MCU to display module	50		**150**	ns	1,2
$T_{TA-SURE(M)}$	Time that the display module waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(M)}$		$2*T_{LPX(M)}$	ns	2
$T_{LPX(D)}$	Transmitted length of any Low-Power state period of display module to MCU	50		150	ns	1,2
$T_{TA-GET(D)}$	Time that the display module drives the Bridge state (LP-00) after accepting control during a Link Turnaround.		$5*T_{LPX(D)}$		ns	2
$T_{TA-GO(D)}$	Time that the display module drives the Bridge state (LP-00) before releasing control during a Link Turnaround.		$4*T_{LPX(D)}$		ns	2
$T_{TA-SURE(D)}$	Time that the MPU waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(D)}$		$2*T_{LPX(D)}$	ns	2

NOTE:
1. T_{LPX} is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.
2. Transmitter-specific parame

4.3 DSI voide mode interface Timing



Symbol	Parameter	Condition	Min	Typ	Max	Units
BR_{PHY}	Bit rate perl Lane	Full-HD(1080RGB x 1920)	80	-	1000	Mbps
t_L	Line time	Full-HD(1080RGB x 1920)	-	8.6 (note1)	-	us
HACT	Active pixel per line	Full-HD(1080RGB x 1920)	-	1080	-	Pxels
t_{HBP}	Horizontal back porch	Full-HD(1080RGB x 1920)	TBD	-	-	DCK
t_{HACT}	Time for image data	4 lanes	-	1080	-	DCK
t_{HFP}	Horizontal front porch	Full-HD(1080RGB x 1920)	TBD	-	-	DCK
VSA	Vertical sync active	Full-HD(1080RGB x 1920)	2	-	-	H
VBP	Vertical back porch	Full-HD(1080RGB x 1920)	TBD	-	-	H
VACT	Active lines per frame	Full-HD(1080RGB x 1920)	-	1920	-	H
VFP	Vertical front porch	Full-HD(1080RGB x 1920)	TBD	-	-	H

Note1: Frame rate (Typ)=60Hz, VBP=8, and VFP=8.
Note2: VBP(min) value depends on GOA timing.

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VDD~GND	-0.3	4.6	V
Logic signal voltage(I/O)	VDD1~GND	-0.3	4.6	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VDD	2.5	2.8	3.3	V
Logic operating voltage	VDD1	1.65	1.8	3.3	V
Input Current	IDD	-	TBD	-	mA

Input Voltage ' H ' level	VIH	0.7IVDD1	-	VDD1	V
Input Voltage ' L ' level	VIL	GND	-	0.3VDD1	
Output Voltage ' H ' level	VOH	0.8VDD1	-	VDD1	
Output Voltage ' L ' level	VOL	GND	-	0.2VDD1	

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	-	19.2	-	V
Current for LED backlight	I_f	-	40	-	mA
Power consumption	Wbl	-	768	-	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	40000	-	Hrs

Note:

1.The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.

2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.

3. Typical operating life time is an estimated data.

4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	θ = 0°	-	20	30	ms	Note 5
Contrast ratio	CR	θ = 0°	-	1000	-		Note 2,6
Viewing angle	Top	CR≧10	-	80	-	Deg.	Note 2,6,7
	Bottom	CR≧10	-	80	-		
	Left	CR≧10	-	80	-		
	Right	CR≧10	-	80	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	θ = 0°	0.275	0.285	0.295		Note 3
	Wy		0.303	0.313	0.323		
	Rx		0.609	0.624	0.639		
	Ry		0.316	0.331	0.346		
	Gx		0.281	0.296	0.311		
	Gy		0.562	0.577	0.592		
	Bx		0.128	0.143	0.158		
	By		0.094	0.109	0.124		
NTSC			57%	60%	-		Note 3
Cross talk	Ct		-	-	2%		Note 9
Transmittance	Trans		-	3.9%	-		Note 4

Note 1: Ambient temperature = 25°C.

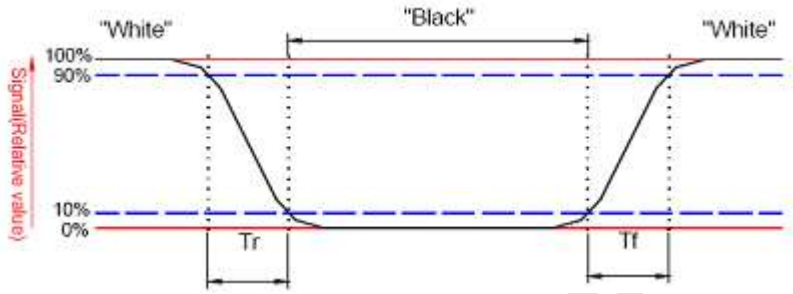
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

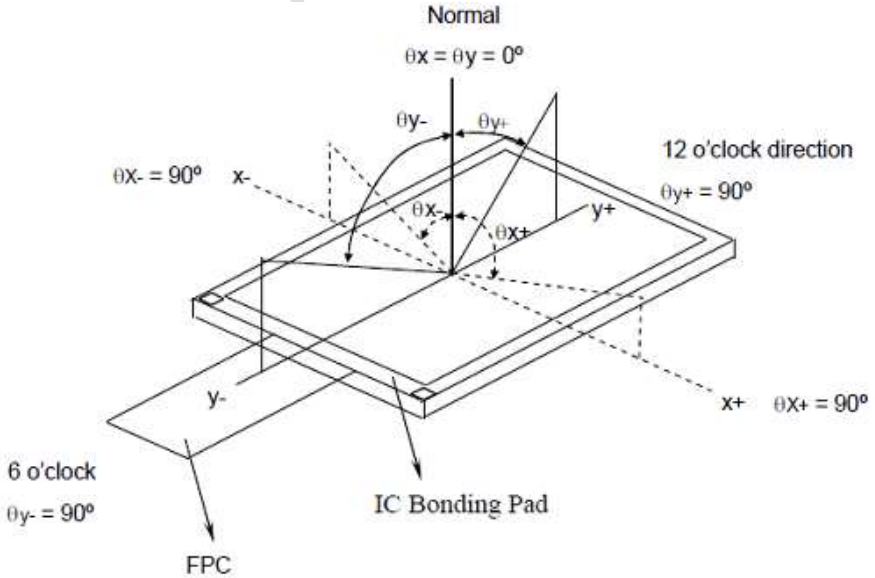


Note 6: Definition of contrast ratio:

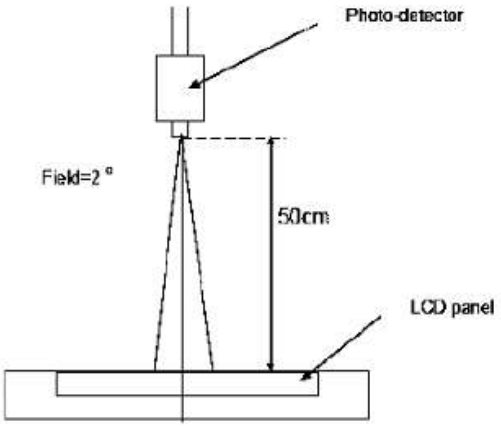
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

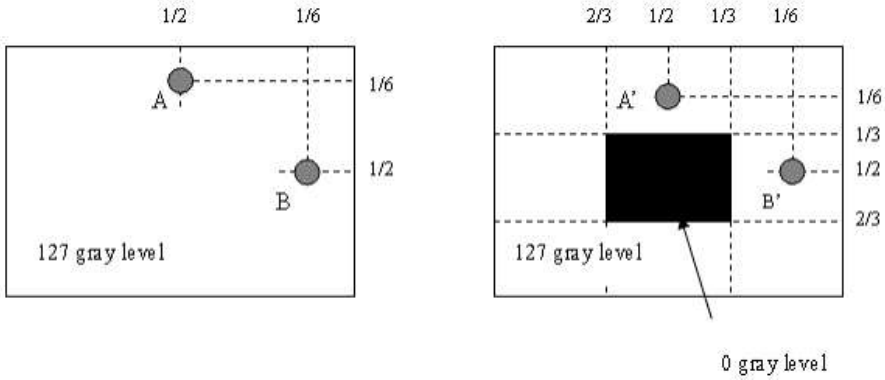
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



l LA-LA'l / LA x 100%= 2% max., LA and LA' are brightness at location A and A'.

l LB-LB'l / LB x 100%= 2% max., LB and LB' are brightness at location B and B'.

9 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	70±2°C/96 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack
2	Low Temperature Storage	-20±2°C/96 hours	
3	High Temperature Operating	60±2°C/96 hours	
4	Low Temperature Operating	-10±2°C/96 hours	
5	Temperature Cycle	-30±2°C ~ 25~ 70± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 80 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times	

10 Suggestions for using LCD modules

10.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don’t disassemble the LCM.

8. 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 modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling 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.

9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

10.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.