



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.: TST050HDBS-42

Version: V1.1

☐ 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	2019-08-10	Initial Release	
V1.1	2020-02-18	Modify the backlight Power	Page 10

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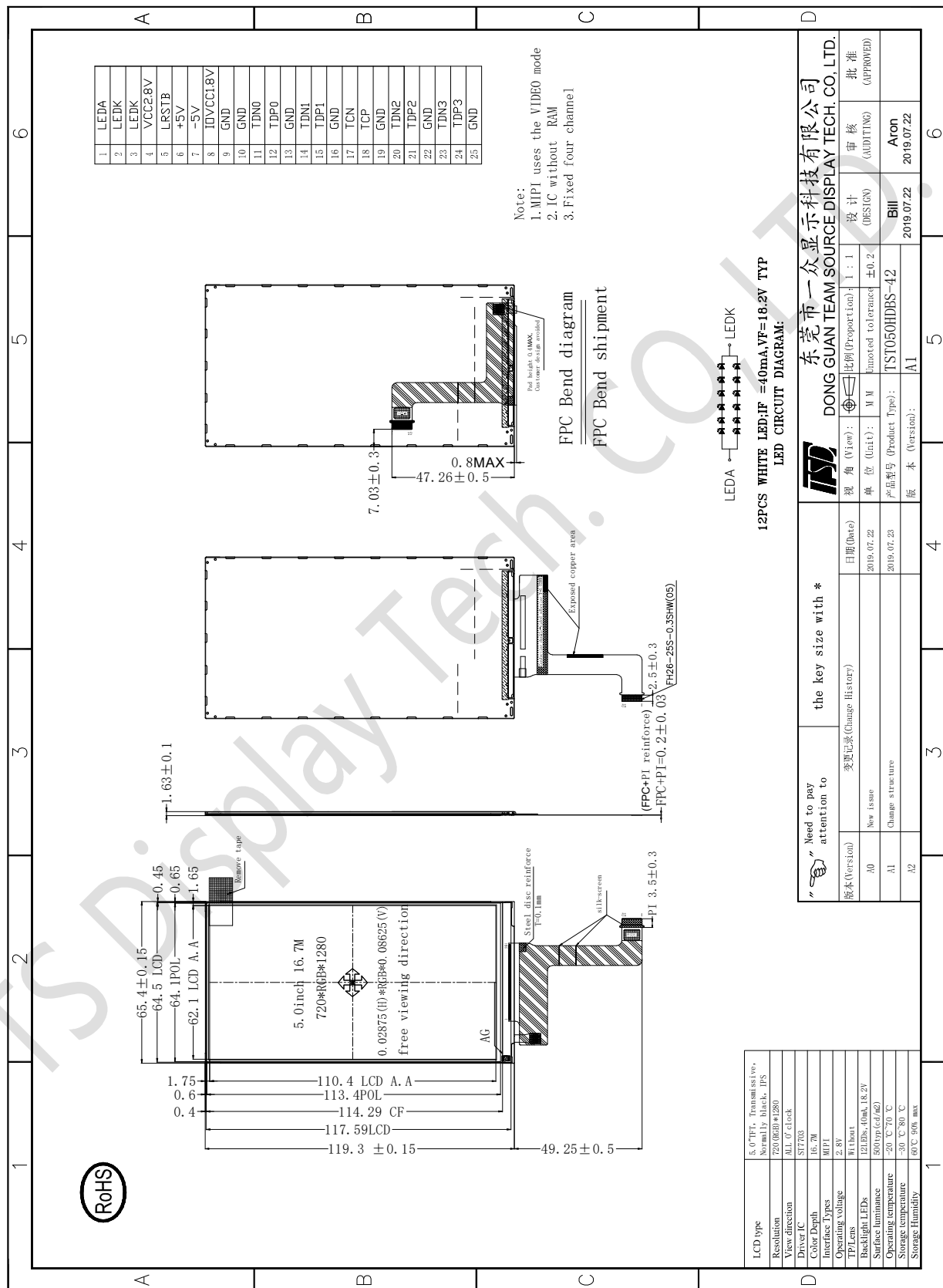
1 General Characteristics

ITEM	Specification	Unit
LCD Type	TFT, Transmissive, Normally black, IPS	-
LCD Size	5.0	inch
Resolution (W x H)	720 x (RGB) × 1280	pixel
LCM (W × H × D)	65.4(W) x 119.3(H) x 1.63(D)	mm
Active Area (W × H)	62.1 (W) x 110.4 (H)	mm
Dot Pitch (W × H)	0.02875 x 0.08625	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	500	cd/m2
Surface Treatment	-	-
Polarizer	-	-
Driver IC	ST7703	-
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

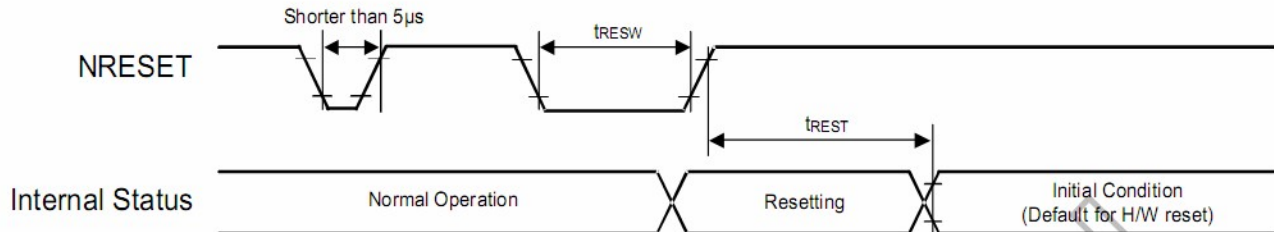


3 Interface description

PIN NO.	Symbol	description
1	LEDA	Backlight A Aothod input pin.
2	LEDK	Backlight K Cathode input pin.
3	LEDK	Backlight K Cathode input pin.
4	NC	No connect
5	LRSTB	Reset input signal
6	+5V	Power voltage input pin +5V
7	-5V	Power voltage input pin -5V
8	IOVCC1.8V	Voltage input pin for logic I/O +1.8V
9	GND	System Ground. (0V)
10	GND	System Ground. (0V)
11	TDN0	MIPI data cathode input pin
12	TDP0	MIPI data aothod input pin
13	GND	System Ground. (0V)
14	TDN1	MIPI data cathode input pin
15	TDP1	MIPI data aothod input pin
16	GND	System Ground. (0V)
17	TCN	MIPI clock cathode input pin
18	TCP	MIPI clock aothod input pin
19	GND	System Ground. (0V)
20	TDN2	MIPI data cathode input pin
21	TDP2	MIPI data aothod input pin
22	GND	System Ground. (0V)
23	TDN3	MIPI data cathode input pin
24	TDP3	MIPI data aothod input pin
25	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°C

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 interface Timing Characteristics

High Speed Mode

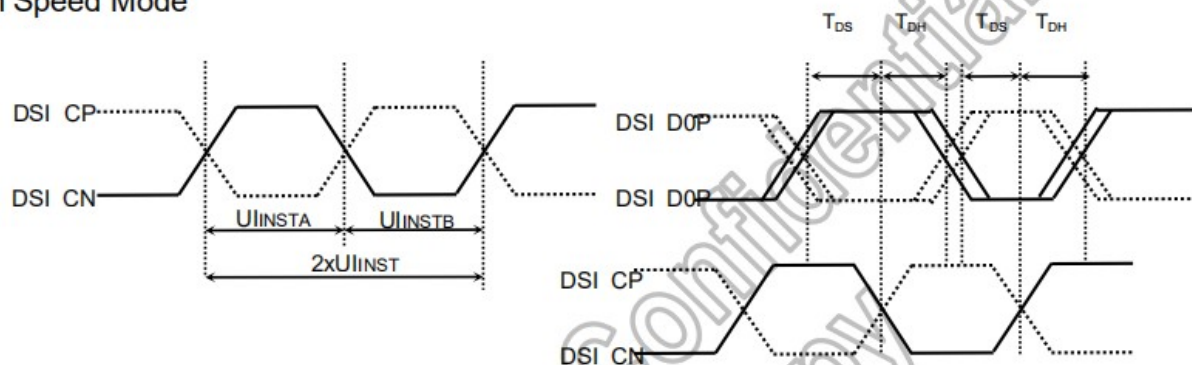


Figure 7.4: DSI clock timing Characteristics

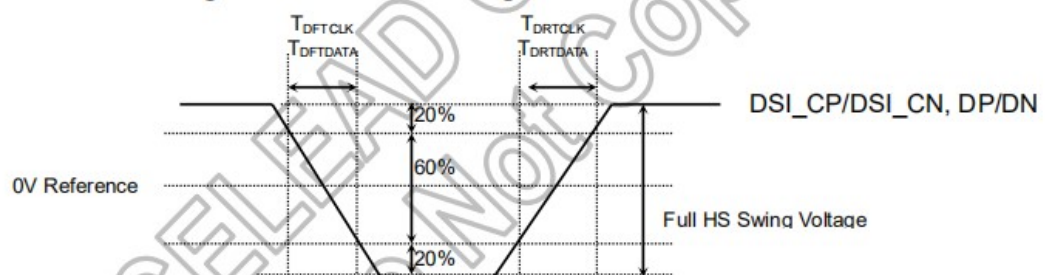


Figure 7.5: Rising and falling time on clock and data channel

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

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	2xU _{INST}	TBD	-	25	ns
	UI instantaneous	U _{INSTA} U _{INSTB}	TBD	-	12.5	ns
DP/DN	Data to clock setup time	T _{DS}	0.15xUI	-	-	ps
	Data to clock hold time	T _{DH}	0.15xUI	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	T _{DRTCLK}	150	-	0.3UI	ps
	Differential fall time for clock	T _{DFTCLK}	150	-	0.3UI	ps
DP/DN	Differential rise time for data	T _{DRTDATA}	150	-	0.3UI	ps
	Differential fall time for data	T _{DFTDATA}	150	-	0.3UI	ps

Table 7.3: DSI High Speed Mode Characteristics

Low Power Mode

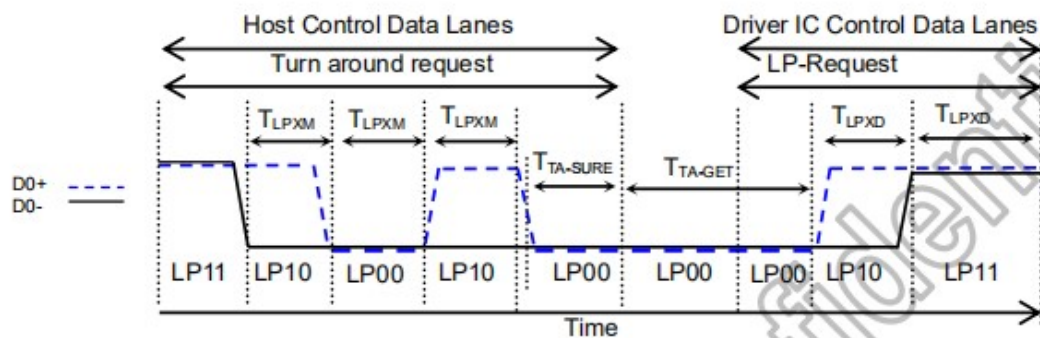


Figure 7.6: BTA from HOST to Display Module Timing

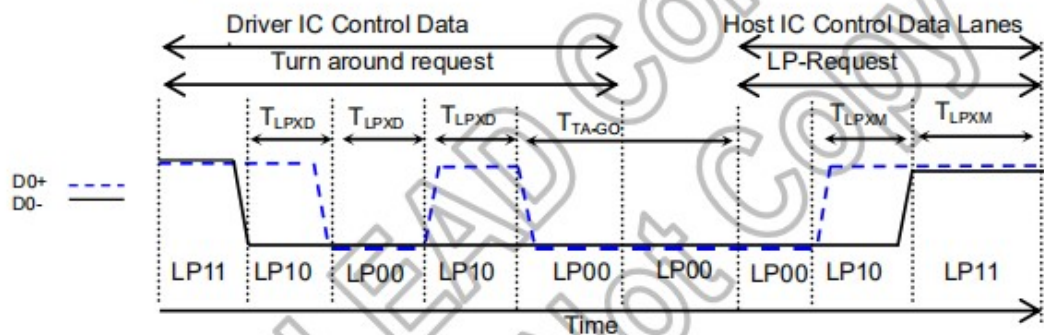


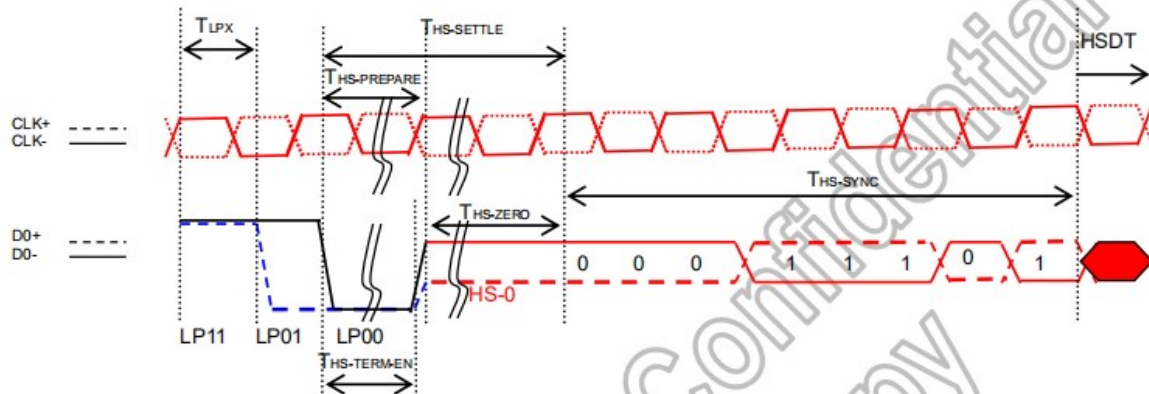
Figure 7.7: BTA from Display Module Timing to HOST

(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_D0P	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 _{TAGO}	4xT _{LPXD}	-	-	ns

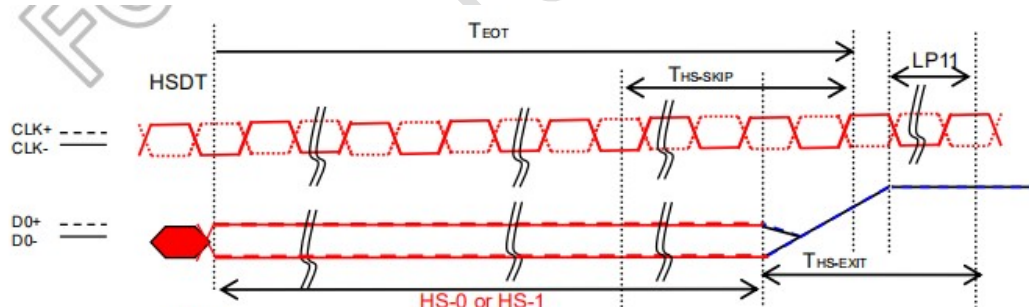
Table 7.4: DSI Low Power Mode Characteristics

DSI BURSTS



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T _{LPX}	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	T _{HS-PREPARE}	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	T _{HS-TERMEN}	-	-	35+4xUI	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 _{TAGO}	4xT _{LPXD}	-	-	ns

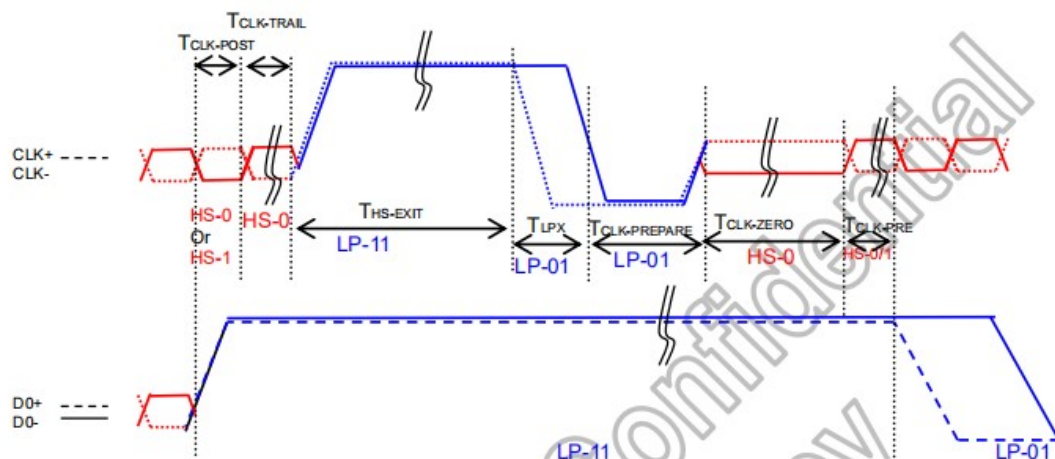
Table 7.5: DSI Low Power Mode to High Speed Mode Timing



NOTE:
If the last bit is HS-0, the transmitter changes from HS-0 to HS-1
If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	T _{HS-SKIP}	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	T _{HS-EXIT}	100	-	-	ns

Table 7.6: DSI Low Power Mode to High Speed Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	T _{CLK-POST}	60+52xUI	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	T _{CLK-TRAIL}	60	-	-	ns
	Time to drive LP-11 after HS burst	T _{HS-EXIT}	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	T _{CLK-PREPARE}	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	T _{CLK-TERM-EN}	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	T _{CLK-PREPARE} + T _{CLK-ZERO}	300	-	-	ns
	Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode	T _{CLK-PRE}	8xUI			

Table 7.7: Clock Lanes High Speed Mode to/from Low Power Mode Timing

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCC~GND	-0.3	4.6	V
Logic signal voltage(I/O)	IOVCC~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
VSP booster voltage	+5V	4.5	-	6.2	V
VSN booster voltage	-5	-6.2	-	-4.5	V
Logic operating voltage	IOVCC	1.65	1.8	3.3	V
Input Current	IDD	-	TBD	-	mA
Input Voltage 'H' level	VIH	0.7IOVCC	-	IOVCC	V

Input Voltage ' L ' level	VIL	GND	-	0.3IOVCC	
Output Voltage ' H ' level	VOH	0.8IOVCC	-	IOVCC	
Output Voltage ' L ' level	VOL	GND	-	0.2IOVCC	

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	-	18.2	-	V
Current for LED backlight	I_f	-	40	-	mA
Power consumption	Wbl	-	728	-	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 $T_a=25^{\circ}\text{C}$, 60%RH $\pm 5\%$.
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)	$Tr+Tf$	$\theta = 0^{\circ}$	-	20	30	ms	Note 5
Contrast ratio	CR	$\theta = 0^{\circ}$	-	1000	-		Note 2,6
Viewing angle	Top	$CR \geq 10$	-	80	-	Deg.	Note 2,6,7
	Bottom	$CR \geq 10$	-	80	-		
	Left	$CR \geq 10$	-	80	-		
	Right	$CR \geq 10$	-	80	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	W_x	$\theta = 0^{\circ}$	0.275	0.285	0.295		Note 3
	W_y		0.303	0.313	0.323		
	R_x		0.609	0.624	0.639		
	R_y		0.316	0.331	0.346		
	G_x		0.281	0.296	0.311		
	G_y		0.562	0.577	0.592		
	B_x		0.128	0.143	0.158		
	B_y		0.094	0.109	0.124		
NTSC			57%	60%	-		Note 3
Cross talk	C_t		-	-	2%		Note 9
Transmittance	Trans		-	3.9%	-		Note 4

Note 1: Ambient temperature = 25°C .

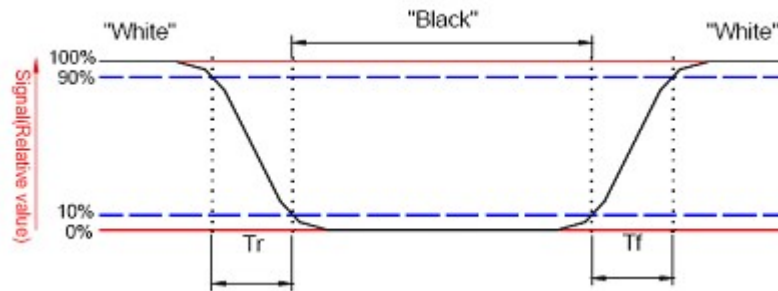
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

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 $\pm 10\%$.

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.

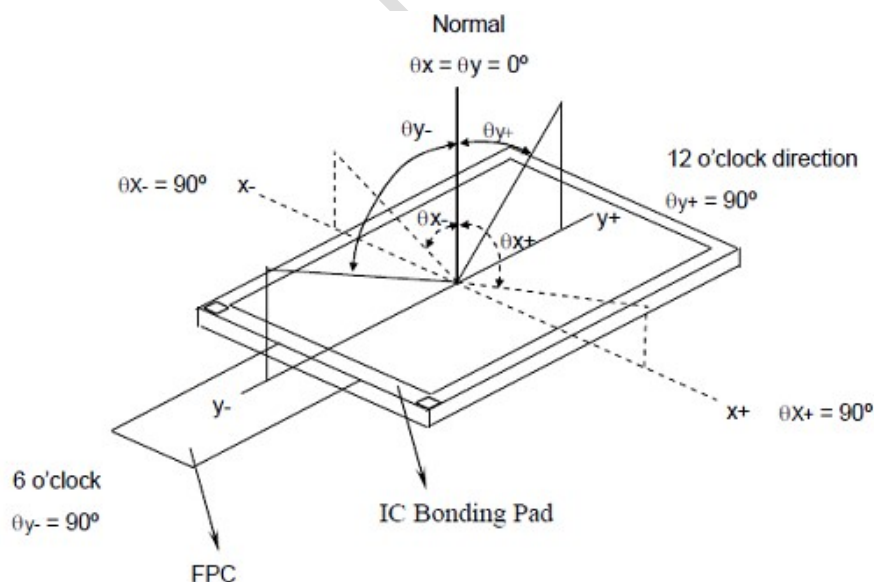


Note 6: Definition of contrast ratio:

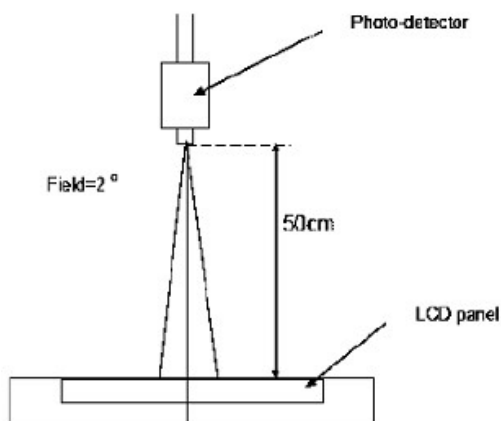
Contrast ratio is calculated by the following formula.

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

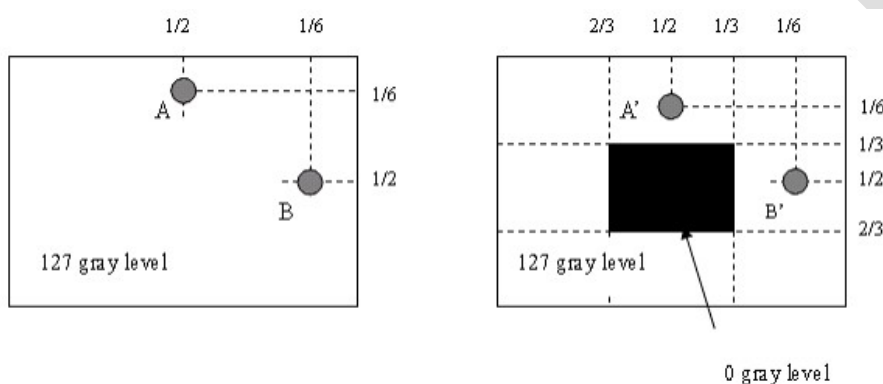
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



1 $LA-LA' / LA \times 100\% = 2\% \text{ max.}$, LA and LA' are brightness at location A and A'.

1 $LB-LB' / LB \times 100\% = 2\% \text{ max.}$, 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	$80 \pm 2^\circ\text{C}/96 \text{ hours}$	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	$-30 \pm 2^\circ\text{C}/96 \text{ hours}$	
3	High Temperature Operating	$70 \pm 2^\circ\text{C}/96 \text{ hours}$	
4	Low Temperature Operating	$-20 \pm 2^\circ\text{C}/96 \text{ hours}$	
5	Temperature Cycle	$-30 \pm 2^\circ\text{C} \sim 25 \sim 80 \pm 2^\circ\text{C} \times 10 \text{ cycles}$ (30 min.) (5min.) (30min.)	
6	Damp Proof Test	$60^\circ\text{C} \pm 5^\circ\text{C} \times 90\% \text{RH}/96 \text{ hours}$	
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: $\pm 8KV$ 150pF/330 Ω 30 times Contact: $\pm 4KV$, 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.

