

SPECIFICATIONS

MODEL NO.	S90451-DI050HD
ZTE MODEL	SU50HDAUNOA01
TYPE	LCD MODULE, 720(RGB) * 1280 PIXELS

Preliminary Specification

Final Specification

SUCCESS			CUSTOMER
PREPARED	CHECKED	APPROVED	APPROVED

深圳市宇顺电子股份有限公司

SUCCESS ELECTRONICS LTD

“ Not to use the substances and their applications of SUCCESS Management Standard for Environment-related Substances to be Controlled”

The copyright belongs to SUCCESS. Any unauthorized use is prohibited.

RECORDS OF REVISION

REV.	DATE	Page	DESCRIPTION OF CHANGES
01	2012.12.19		FIRST ISSUE
02	2013.01.23	6	UPDATE MECHANICAL DRAWING

CONTENT

- 1. GENERAL SPECIFICATION..... 4
- 2. BLOCK DIAGRAM..... 5
- 3. MECHANICAL DRAWING..... 6
- 4. INTERFACE ASSIGNMENT..... 7
- 5. ELECTRICAL SPECIFICATION..... 8
- 6. OPTICAL CHARACTERISTICS..... 15
- 7. RELIABILITY TESTS..... 19
- 8. PRECAUTIONS..... 20
- 9. LIMITED WARRANTY..... 20

1. GENERAL SPECIFICATION

1.1 Description

The S90451-DI050HD is a color active matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) that uses amorphous silicon(a-Si) TFT as a switching device. This model is composed of a single 5.0 inches transmissive type main TFT-LCD panel. The resolution of the panel is 720 x1280 pixels and can display up to 16.7M color.

1.2 Feature

- VA type for main TFT-LCD panel
- Structure COG+FPC+BL
- Full, Normal (Still), Partial, Sleep, Standby mode are available

1.3 Application

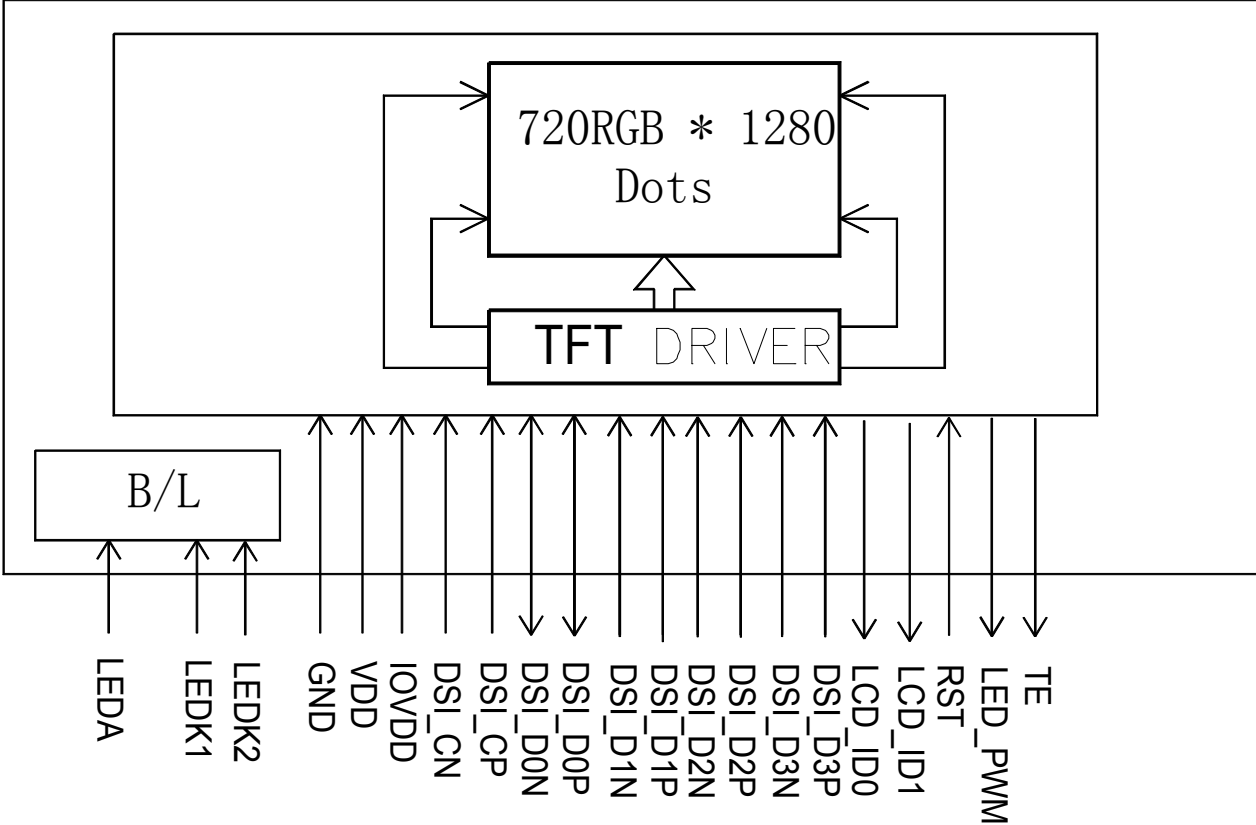
- Display terminals for cellular phone or equivalent.

1.4 General Specification

No.	Item	Specification	Unit	Remark
1	LCD Size	4.99	inch	-
2	Panel Type	a-Si TFT active matrix	-	-
3	Resolution	720x (RGB) x 1280	pixel	-
4	Display Mode	Normally Black, Transmissive	-	-
5	Display Number of Colors	16.7M	-	-
6	Viewing Direction	ALL	-	Note
7	Contrast Ratio	800(TYP)	-	-
8	Luminance	500(TYP)	cd/m ²	-
9	Module Size	65.00(W) × 119.75(L) × 1.55(T)	mm	Note
10	Active Area	62.10(W) × 110.40(L)	mm	Note
11	Pixel Pitch	0.08625(W) × 0.08625(L)	mm	-
12	Weight	-	g	-
13	Driver IC	NT35590B	-	-
14	Driver IC RAM Size	-	bit	-
15	Light Source	12LEDs White	-	-
16	Interface	VIDEO MIPI	-	-
17	Operating Temperature	-20~70	°C	-
28	Storage Temperature	-30~80	°C	-

Note: Please refer to the mechanical drawing.

2. BLOCK DIAGRAM



3. MECHANICAL DRAWING

MIPPI video mode, 4 lane

pin	Assignment
1	LVDS
2	LD_ID1
3	LD_ID0
4	RST
5	GD
6	BSL_DP
7	BSL_DN
8	GD
9	BSL_DP
10	BSL_DN
11	GD
12	BSL_DP
13	BSL_DN
14	GD
15	BSL_DP
16	BSL_DN
17	GD
18	BSL_DP
19	BSL_DN
20	GD
21	TE
22	VDD
23	VDD
24	NC
25	LED1
26	LED2
27	LED2
28	VC(MTP)
29	NC
30	LED_PWM
31	GD

Notes (All: NT35590B)
 Lane number is selected by register
 BAH = 0x00 MIPPI DSI with 1 lane
 BBAH = 0x01 MIPPI DSI with 2 lanes
 BBAH = 0x02 MIPPI DSI with 3 lanes
 BBAH = 0x03 MIPPI DSI with 4 lanes

Display Type	4.99TFT/TRANSMISSIVE
Viewing Angle	All
Driver IC	NT35590B
Interface	Video MIPI (4 Lane)
Operating Voltage	VDD=2.8V DVDD=1.8V
Luminance	300cd/m ² (typ.)/500cd/m ² (min)
Center coordinate	x:0.317/0.00, y:0.30/0.00(中心距)
Backlight	WHITE(18V, 20mA/LED)
Connector type	FH26-31S-0.35MM(05)
Operation Temp.	-20°C TO 60°C
Storage Temp.	-30°C TO 70°C

BACKLIGHT CIRCUIT

技术要求:
 1) 液晶显示模式: 4.99" TFT transmissiv
 2) 显示颜色: 16.7M COLORS
 3) 点阵: 720XRGBX1280 DOTS
 4) 驱动芯片型号: NT35590B
 5) 工作温度: -20°-----70°
 储存温度: -30°-----70°
 6) 未注尺寸公差: ±0.2mm
 7) 材料及工艺符合 ROHS
 8) 带*为重点尺寸

胶框铁框一体化成型
 铁框材质: SUS304或SUS305, 厚度0.15MM
 LCD warp is ≤ 0.3(目标值)
 偏光片距离玻璃边缘0.3
 CPK>=1.33
 屏本身需要支持倒置
 全贴水滴角要求小于70°

Not to use the substances and their applications or SUCCESS Management Standard for Environment-related Substances to be Confirmed

VER.	SYMBOL	AMENDMENT
04	Δ	增加FPC双面胶, 增加绿油, 增加遮光纸
03		增加钢印
02		修改工艺孔设计
01		新设计

DRAWN	Huang Yu
CHECKED	Huang Yu
APPROVED	Huang Yu
CUSTOMER'S APPROVAL	Huang Yu
DATE	20121217
SIGN	

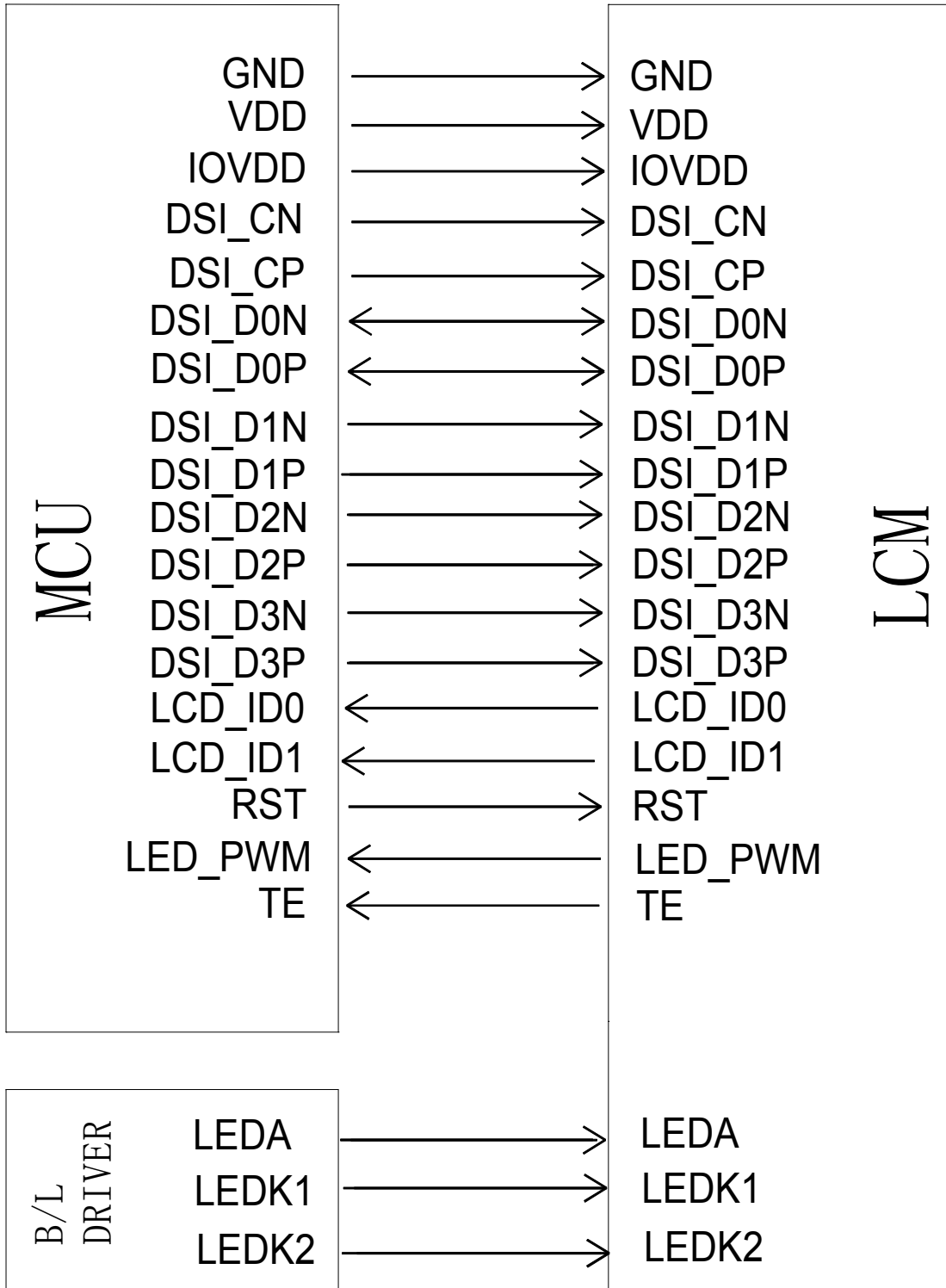
TITLE	
MODULE SPEC.	DRAWING NO. STR-S90451-DI050HD
UNIT: mm	SCALE: FIT
3rd Angle	SHEET 1 OF 1
SHENZHEN SUCCESS ELECTRONIC CO., LTD	

4. INTERFHACE ASSIGNMENT

PIN NO.	SYMBOL	FUNCTION DESCRIPTIONS
1	LANE_SEL	NC.
2	LCD_ID1	For user. Now connect to IOVDD.
3	LCD_ID0	For user. Now connect to IOVDD.
4	RST	Reset pin.
5	GND	Ground.
6	DSI_D0P	MIPI-DSI data Lane 0 positive-end input/output pin.
7	DSI_D0N	MIPI-DSI data Lane 0 negative-end input/output pin.
8	GND	Ground.
9	DSI_D1P	MIPI-DSI data Lane 1 positive-end input pin.
10	DSI_D1N	MIPI-DSI data Lane 1 negative-end input pin.
11	GND	Ground.
12	DSI_CP	MIPI-DSI clock Lane positive-end input pin.
13	DSI_CN	MIPI-DSI clock Lane negative-end input pin.
14	GND	Ground.
15	DSI_D2P	MIPI-DSI data Lane 2 positive-end input pin.
16	DSI_D2N	MIPI-DSI data Lane 2 negative-end input pin.
17	GND	Ground.
18	DSI_D3P	MIPI-DSI data Lane 3 positive-end input pin.
19	DSI_D3N	MIPI-DSI data Lane 3 negative-end input pin.
20	GND	Ground.
21	TE	Frame head pulse signal.
22	VDD	Power supply to liquid crystal power supply analog circuit.
23	IOVDD	Power supply to interface pins.
24	NC	NC.
25	LEDA	Power supply for backlight (anode).
26	LEDK1	Power supply for backlight (canode).
27	LEDK2	Power supply for backlight (canode).
28	NC	NC.
29	NC	NC.
30	LED_PWM	LCD backlight control PWM output pin.
31	GND	Ground.

5. ELECTRICAL SPECIFICATION

5.1. APPLICATION CIRCUIT



5.2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
Power Supply for Analog	VDD	Ta=25 °C	-0.3	-	5.5	V
Power Supply for Digital IO	IOVDD	Ta=25 °C	-0.3	-	5.5	V

Note: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is applied.

5.3. TYPICAL OPERATION CONDITION**5.3.1 DC Characteristics**

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
Power Supply for Analog	VDD	Ta=25 °C	2.6	2.8	4.8	V
Power Supply for Digital IO	IOVDD	Ta=25 °C	1.65	1.8	3.6	V
Input Signal “H” Level	VIH	-	0.7IOVDD	-	IOVDD	V
Input Signal “L” Level	VIL	-	0	-	0.3IOVDD	V
Output Signal “H” Level	VOH	IOH=-0.1mA	0.8IOVDD	-	IOVDD	V
Output Signal “L” Level	VOL	IOL=0.1mA	0	-	0.2IOVDD	V
Frame Frequency	fFRAME	-	60	70	85	Hz
TFT gate on voltage	VGH	-	+12	+15	+18	V
TFT gate off voltage	VGL	-	-12	-10	-7	V

Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.

5.3.2 Current Consumption

Item	Symbol	Values		Unit	Remark
		Typ.	Max.		
MIPI					
Normal(Still) Mode	I _{CC1}	TBD	TBD	mA	Note1
Sleep Mode	I _{CC2}	-	TBD	uA	Note2

Note1: Test Condition

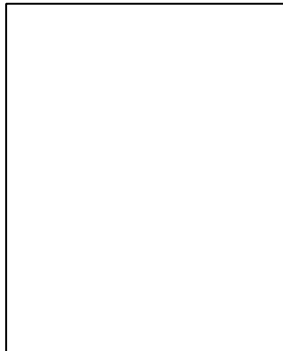
IOVDD=VDD=2.8V;

Display Pattern: All Pixel black

Frame Rate=60Hz at Line Inversion

Operating Temperature: 25°C

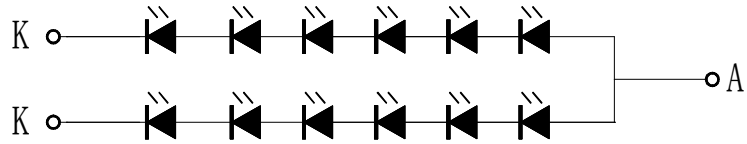
Max. current check pattern:



Note2: In the standby mode, all the internal display operations are suspended including the internal R-C oscillator.

5.4. BACKLIGHT SPECIFICATION

5.4.1 BACKLIGHT CIRCUIT



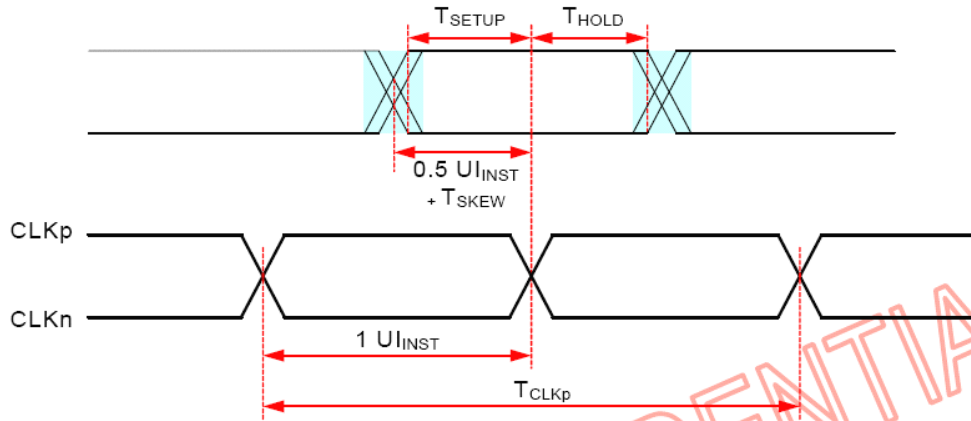
5.4.2 ELECTRICAL CHARACTERISTICS

(T=25°C)

PARAMETER	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
FORWARD VOLTAGE (Single Chip)	VF	IF=20mA	2.9	3.0	3.2	V

5.5. INTERFACE TIMING CHARACTERISTICS

High Speed Data Transmission: Data-Clock Timing

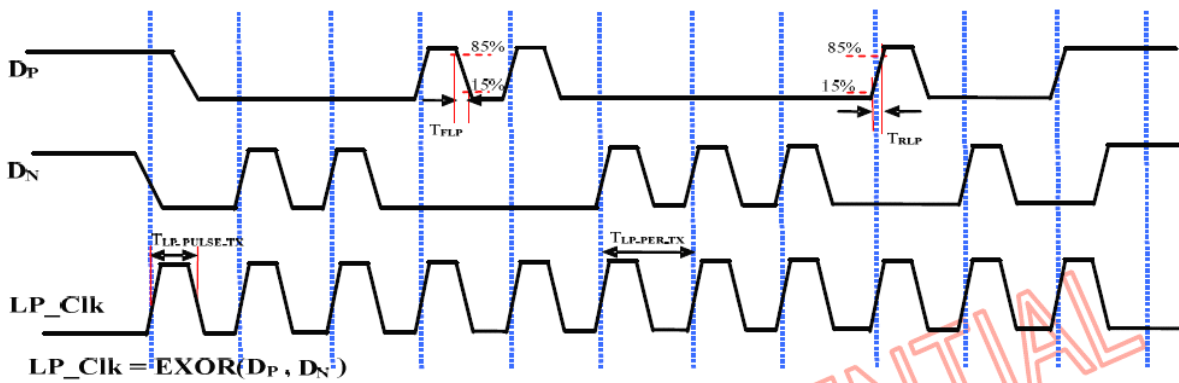


Parameter	Symbol	Min	Typ	Max	Units	Notes
UI instantaneous	UI_{INST}	1.176		12.5	ns	1,2,5
Data to Clock Skew [measured at transmitter]	$T_{SKEW[TX]}$	-0.15		0.15	UI_{INST}	3
Data to Clock Setup Time [measured at receiver]	$T_{SETUP[RX]}$	0.15			UI_{INST}	4
Data to Clock Hold Time [measured at receiver]	$T_{HOLD[RX]}$	0.15			UI_{INST}	4
20% - 80% rise time and fall time	t_r / t_f	150			ps	
				0.3	UI_{INST}	

Note:

- This value corresponds to a minimum 80 MHz data rate.
- The minimum UI shall not be violated for any single bit period, i.e.,any DDR half cycle within a data burst.
- Total silicon and package delay budget of $0.3 \cdot UI_{INST}$.
- Total setup and hold window for receiver of $0.3 \cdot UI_{INST}$.
- For MIPI speed limitation:
 - [1] Per lane bandwidth is 850Mbps.
 - [2] Total Bit Rate: 2Gbps for 8-8-8-; 1.5Gbps for 6-6-6-; 1.33Gbps for 5-6-5-.

LP Transmission AC Specification



Parameter	Symbol	Min	Typ	Max	Units	Notes
15%-85% rise time and fall time	T_{RLP} / T_{FLP}			25	ns	1
30%-85% rise time and fall time	T_{REOT}			35	ns	1,5,6
Pulse width of the LP exclusive-OR clock	First LP exclusive-OR clock pulse after STOP state or last pulse before stop state	40			ns	4
	All other pulses	20			ns	4
Period of the LP exclusive-OR clock	$T_{LP-PER-TX}$	90			ns	
Slew Rate@ $C_{LOAD} = 0pF$	$\Delta V / \Delta t_{GR}$	30		500	mV/ns	1,2,3,7
Slew Rate@ $C_{LOAD} = 5pF$		30		200	mV/ns	1,2,3,7
Slew Rate@ $C_{LOAD} = 20pF$		30		150	mV/ns	1,2,3,7
Slew Rate@ $C_{LOAD} = 70pF$		30		100	mV/ns	1,2,3,7
Load Capacitance	C_{LOAD}			70	pF	1

Note:

- CLOAD includes the low-frequency equivalent transmission line capacitance. The capacitance of TX and RX are assumed to always be <10pF. The distributed line capacitance can be up to 50pF for a transmission line with 2ns delay.
- When the output voltage is between 15% and below 85% of the fully settled LP signal levels.
- Measured as average across any 50 mV segment of the output signal transition.
- This parameter value can be lower than TLPX due to differences in rise vs. fall signal slopes and trip levels and mismatches between Dp and Dn LP transmitters. Any LP exclusive-OR pulse observed during HS EoT (transition from HS level to LP-11) is glitch behavior.
- The rise-time of TREOT starts from the HS common-level at the moment the differential amplitude drops below 70mV, due to stopping the differential drive.
- With an additional load capacitance CCM between 0-60pF on the termination center tap at RX side of the Lane.
- This value represents a corner point in a piecewise linear curve as bellowed.

5.6. RESET TIMING CHARACTERISTICS

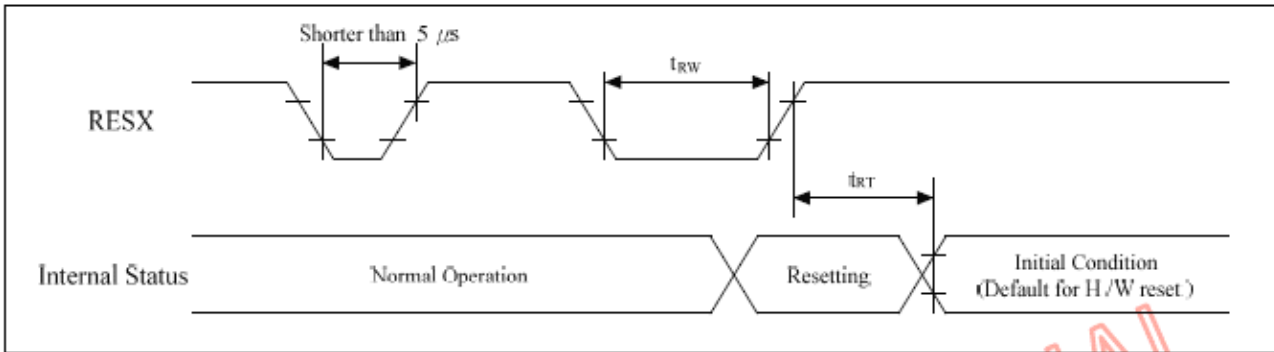


Figure 7.3.4 Reset Operation

Table 7.3.14 Reset Timing Characteristics VCI=2.5~4.8V, VDDI=1.65~3.3V, VDDAM=1.7~4.8V

Signal	Symbol	Parameter	Min.	Max.	Unit
RESX	t_{RW}	Reset pulse duration	10(Note)	-	us
	t_{RT}	Reset cancel	-	10(Note)	ms
			-	120(Note)	ms

Note :

-The reset cancel also includes required time for loading ID bytes, VCOM setting and other settings from EEPROM (or similar device) to registers.

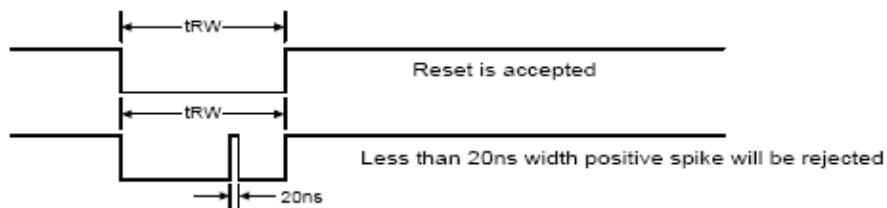
This loading is done every time when there is HW reset cancel time (t_{RT}) within 10 ms after a rising edge of RESX.

-Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below :

RESX	Pulse Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset Starts

-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). Then return to Default condition for Hardware Reset.

-Spike Rejection also applies during a valid reset pulse as shown below :



-When Reset applied during Sleep-In Mode.

-When Reset applied during Sleep-Out Mode.

-It is necessary to wait 5ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120 ms.

6. OPTICAL CHARACTERISTICS

(T_a=+25°C, VDD=+2.8V IOVDD=+2.8V, I_B=40mA)

Item	Symbol	Condition	Values			Unit	Remark	
			Min.	Typ.	Max.			
Viewing Angle Range	Left	θ_L	CR \geq 10	70	80	-	degree	Note 1,2
	Right	θ_R		70	80	-		
	Top	Φ_T		70	80	-		
	Bottom	Φ_B		70	80	-		
Response Time ^m	T _{on} + T _{off}	Normal $\theta = \Phi = 0^\circ$	-	25	-	ms	Note 2,3	
Contrast Ratio	CR	Normal $\theta = \Phi = 0^\circ$	-	800	-	-	Note 2,4	
Luminance	L	Normal $\theta = \Phi = 0^\circ$	450	500	--	cd/m ²	Note 2,5	
Color Chromaticity (CIE1931)	White	W _x	Normal $\theta = \Phi = 0^\circ$	-	0.31	-	-	Note 2,6
		W _y		-	0.32	-		
	Red	R _x		-	0.621	-		
		R _y		-	0.330	-		
	Green	G _x		-	0.304	-		
		G _y		-	0.600	-		
	Blue	B _x		-	0.146	-		
		B _y		-	0.048	-		
Color Gamut	NTSC	CIE1931	-	70	-	%	-	
Luminance Uniformity	U _L	Normal $\theta = \Phi = 0^\circ$	80	-	-	%	Note 2,7	

Note 1: Definition of viewing angle range

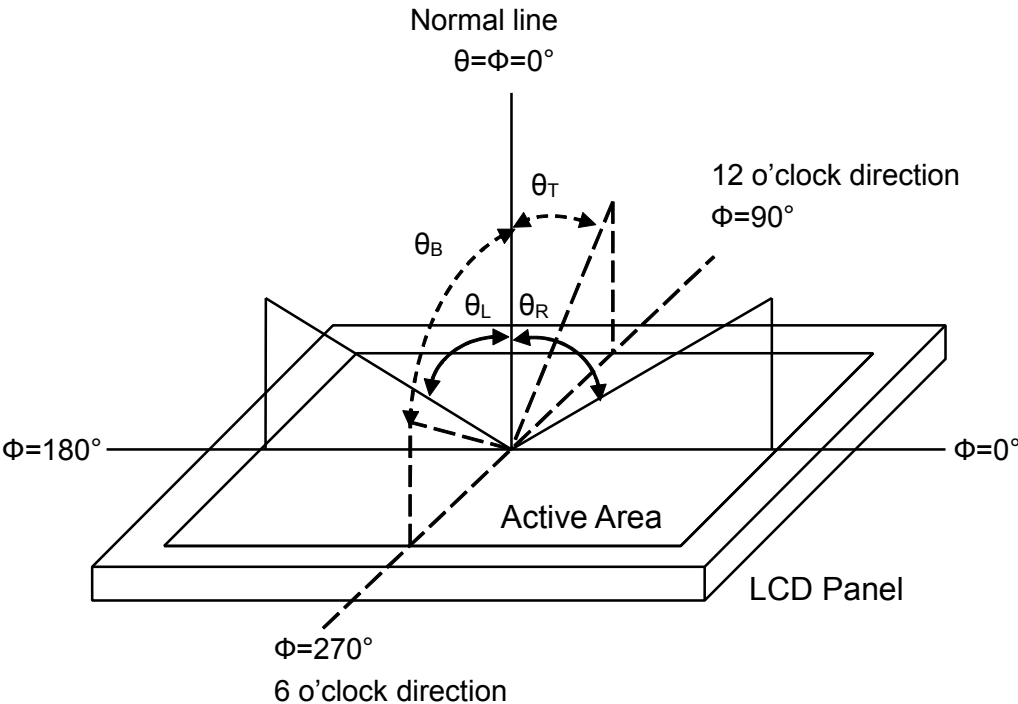


Fig. 1 Definition of viewing angle

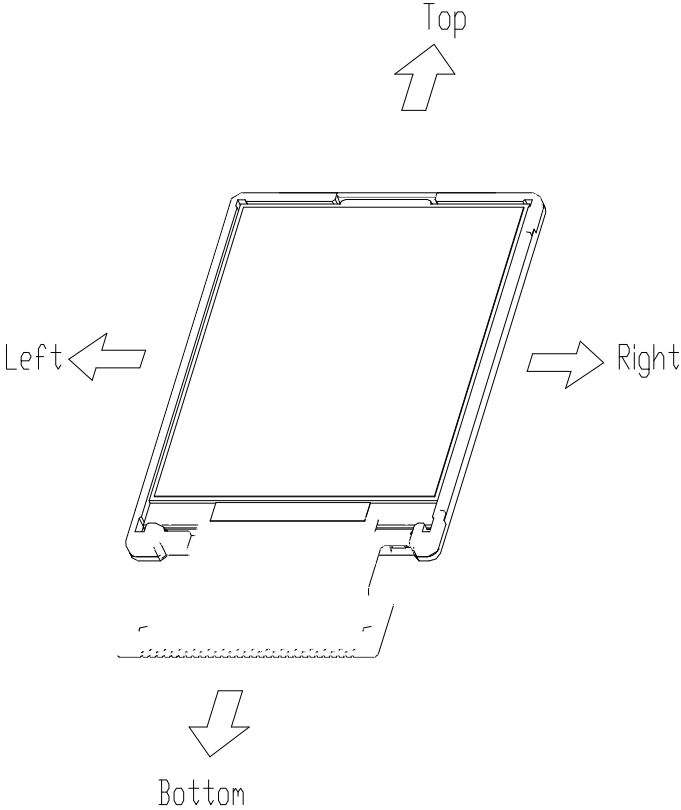


Fig. 2 Definition of viewing angle for display

Note 2: Definition of optical measurement system

The optical characteristics should be measured in a dark room with ambient temperature $T_a=+25\text{ }^\circ\text{C}$. The optical properties are measured at the center point of the LCD screen after 5 minutes operation. (Equipment: Photo detector TOPCON BM-5AS Field of view: 1° /Height: 500mm.)

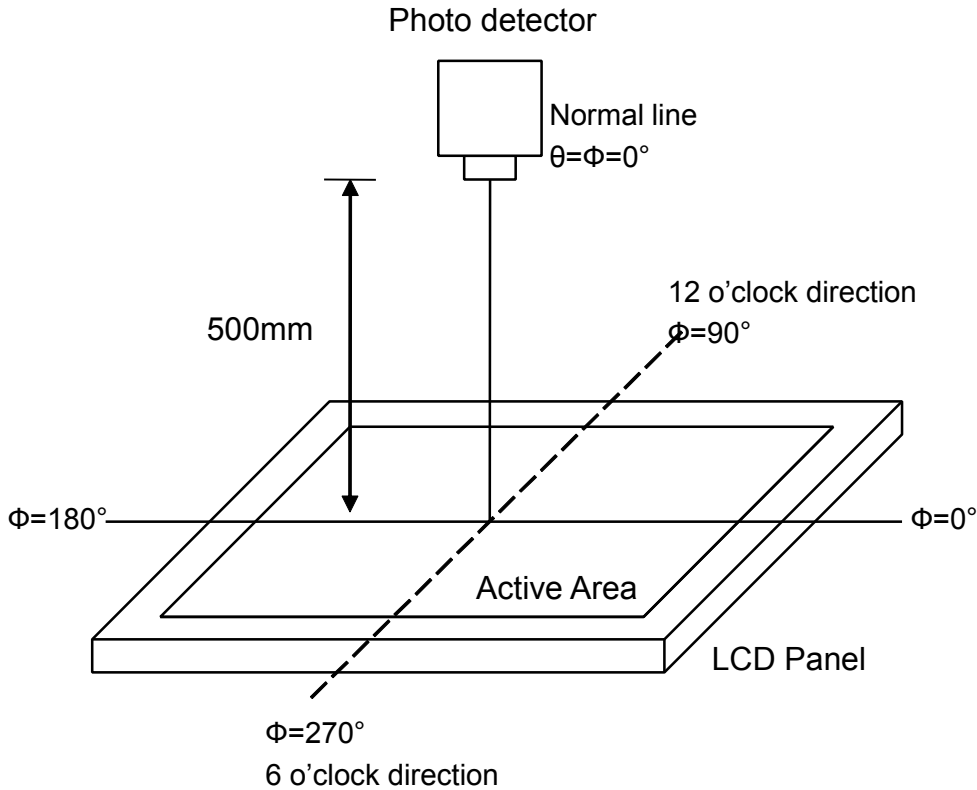


Fig. 3 Optical measurement system setup

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 (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%.

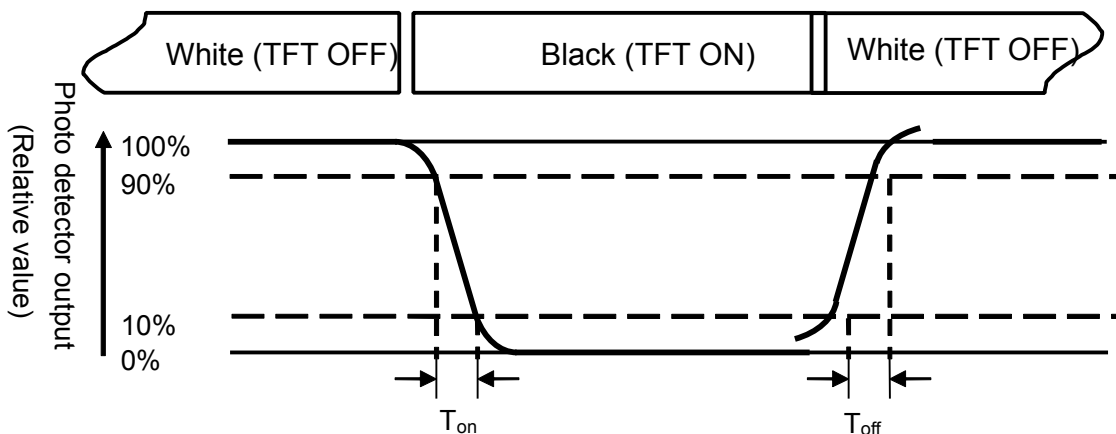


Fig. 4 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of luminance

Measured at the center area of the panel when LCD panel is driven at "white" state.

Note 6: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD when panel is driven at "White", "Red", "Green" and "Blue" state respectively.

Note 7: Definition of luminance uniformity

To test for uniformity, the tested area is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each circle as below.

$$\text{Luminance Uniformity (U}_L\text{)} = \frac{L_{\min}}{L_{\max}}$$

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

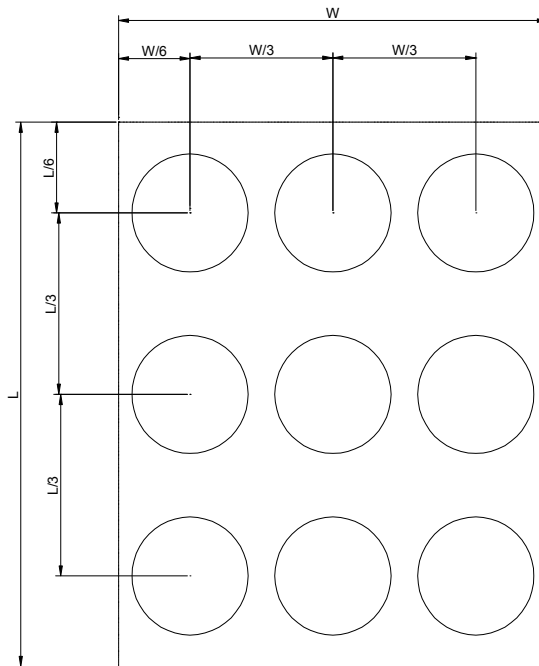


Fig. 5 Definition of luminance uniformity

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

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

7. RELIABILITY TESTS

ITEM	CONDITION	CRITERION
Operating Temperature Test	High Temperature: +70 °C, 120hrs	No defects in display and operational functions
	Low Temperature: -20 °C, 120 hrs	
Storage Temperature Test	High Temperature: +80 °C, 120 hrs	No defects in display and operational functions
	Low Temperature: -30 °C, 120 hrs	
Humidity Endurance Test	60 °C, 90%RH, 120 hrs	No defects in display and operational functions
Thermal Shock Test	-30 °C (30mins)~ +80 °C (30mins) 10 cycles	No defects in display and operational functions
Vibration Resistance Test	Operating Time: thirty minutes exposure for each direction (X,Y,Z) Sweep Frequency:10~55Hz (1 min) Amplitude: 1.5mm	No defects in display and operational functions
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	No defects in display and operational functions
Package Vibration Test	Random Vibration : 0.015G ² /Hz from 5-200Hz, -6dB/Octave from 200-500Hz 1 hour for each direction of X. Y. Z. (3 hours for total)	No defects in display and operational functions
Package Drop Test	Height :72cm(Weight ≤ 10kg); 60cm(Weight ≥ 10kg) 1 corner, 3 edges, 6 surfaces	No defects in display and operational functions
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	No defects in display and operational functions

NOTE:

- 1) The samples must be free from defect before test, must be restored at room condition at least for 2 hours after reliability test before any inspection.
- 2) Before test the function of TP, the sample must be placed in room temperature for 24hrs after RA test.

8. PRECAUTIONS

8.1. HANDLING

8.1.1. Polarizer Cleaning, Petroleum ether (or N-hexane) is recommended for cleaning the front/rear polarizers and reflectors, acetone, toluene and ethanol are not allowed to avoid damaging the surface.

8.1.2. Body grounding, must wear Anti-ESD wrist strap while pick up LCDs.

8.1.3. FPC Soldering, less than 300°C/3S, solder must be grounding on grounding bench.

8.1.4. If use electric Screwdriver to do assembly, screwdriver must be grounding.

8.2. STORAGE

8.2.1. Keep in a sealed polyethylene bag.

8.2.2. Keep in a dark place.

8.2.3. Keep in temperature between 0(C and 35(C.

NOT allowed at 70(C for more than 160 Hours, or at -20(C for more than 48 Hrs.

8.3. SAFETY

If liquid crystal leak out of a damaged glass cell, DO NOT put it in your mouth or touch eyes, if the liquid crystal touch your skin or clothes, please wash it off immediately using soap and water.

9. LIMITED WARRANTY

Unless otherwise agreed between SUCCESS and customer, SUCCESS will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with SUCCESS LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects over specs must be returned to SUCCESS within 30 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of SUCCESS limited to repair and/or replacement on the terms set forth above. SUCCESS shall not be responsible for any subsequent or consequential events.

9.1. RETURNING LCM UNDER WARRANTY – TERMS AND CONDITIONS

9.1.1. No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.

- Circuit modified in any way, including addition of components.

9.1.2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB' s eyelet, conductors and terminals.