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**FN0400D002A**

**Product Specification Rev.V0**

BUYER	
SUPPLIER	FANNAL Electronics CO., LTD
FG-Code	FN0400D002A

- Preliminary Specification
- Approval Specification

ITEM	BUYER SIGNATURE	DATE
Quality	_____	_____
R&D	_____	_____
Approved	_____	_____

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	<u>DONG</u>	<u>2023-04-04</u>
Reviewed	<u>XIONG</u>	<u>2023-04-04</u>
Approved	<u>JACK</u>	<u>2023-04-04</u>

<b>PRODUCT GROUP</b>	REV	ISSUE DATE	
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## REVISION HISTORY

REV.	Page.	DESCRIPTION OF CHANGES	DATE	PREPARED
V0		Initial Release	2023-04-04	JACK

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## 1.0 General Description /一般说明

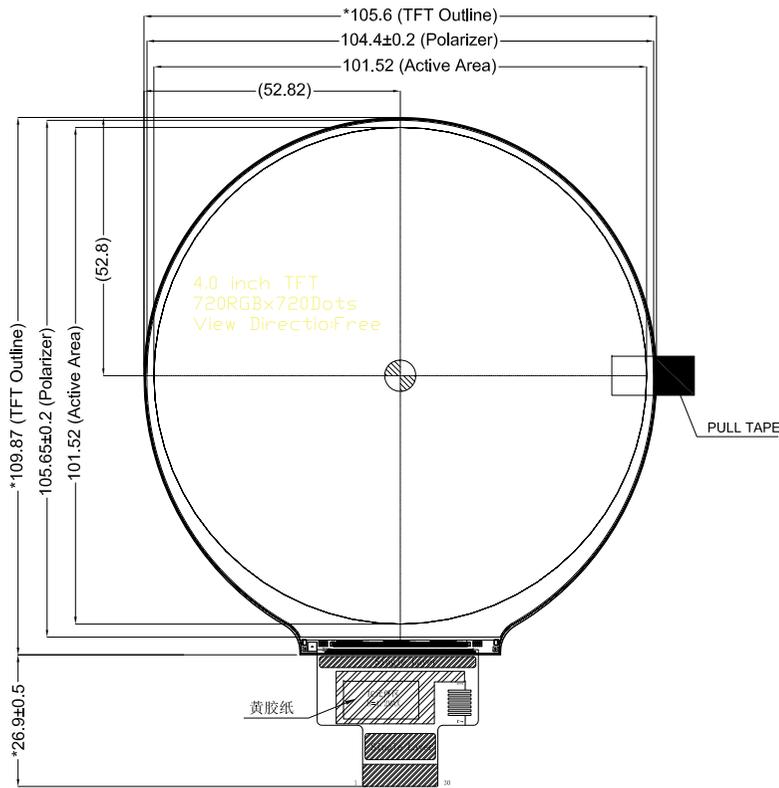
### 1.1 Application

- |  |  |  |
|--|--|--|
| <input checked="" type="checkbox"/> Industrial | <input type="checkbox"/> Fitness equipment   | <input type="checkbox"/> POS                           |
| <input type="checkbox"/> Automotive            | <input type="checkbox"/> Rail traffic        | <input checked="" type="checkbox"/> Digital & Consumer |
| <input type="checkbox"/> Medical               | <input type="checkbox"/> Military-industrial | <input type="checkbox"/> Outdoor highlight             |

### 1.2 General Specification /通用技术条件

Parameter	Specification	Unit
LCD size	4.0 (Diagonal)	inch
Resolution Ratio	720(H)×720(V)	pixels
Pixel Pitch	0.141x0.141(V)	mm
Active Area	101.52(H)×101.52(V)	mm
Module Size	105.6(W)×109.87(H)×2.08(D)	mm
Display Mode	Normally Black	
Interface	MIPI	
Pixel arrangement	RGB-Vertical Stripe	
View Direction	ALL	
Power Supply	2.8	V
Power Consumption	0.25	W
Weight	41	g
Luminance	250 (TYP.)	cd/m <sup>2</sup>
Driver IC	ST7703	

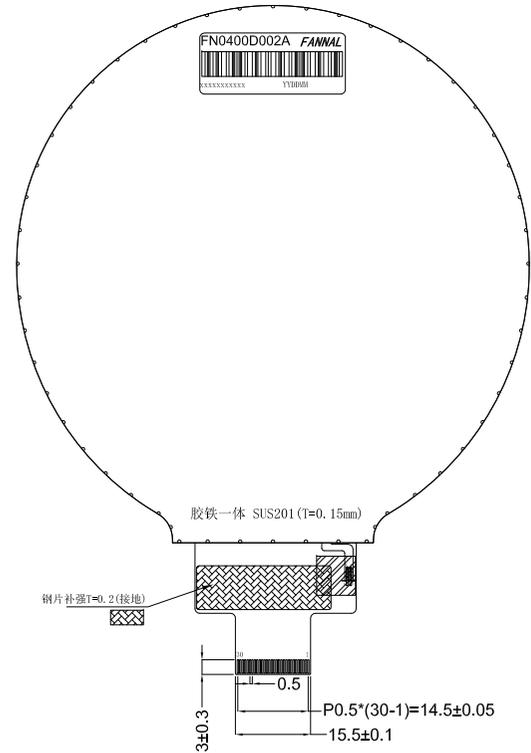
VER.	SYMBOL	AMENDMENT	SIGN	DATE
A		First issue	LCF	2023-04-03



TOP VIEW

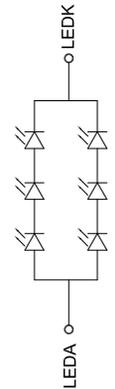


SIDE VIEW



BOTTOM VIEW

LED CIRCUIT DIAGRAM:  
 BACKLIGHT: 3S2P=6 CHIP-WHITE LED  
 IF=40mA ; VF=8.4~9.9V



SIZE	4.0 Inch	Interface	MIPI	PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL
Resolution Ratio	720x720	Power Supply	2.8V	1	LEDA	13	DIP	25	TP_INT			1	GND
LCD Type	<input checked="" type="checkbox"/> Transmissive	Connection Mode	<input checked="" type="checkbox"/> FPC Plug-in	2	LEDK1	14	DIN	26	TP_SDA			2	TP_INT
	<input type="checkbox"/> Transflective		<input type="checkbox"/> FPC Soldering	3	LEDK2	15	GND	27	TP_SCL			3	TP_SDA
	<input type="checkbox"/> Reflective		<input type="checkbox"/> Connector	4	VCI	16	CLKP	28	TP_RESET			4	TP_SCL
Display Mode	<input checked="" type="checkbox"/> Normally Black	Driver IC	ST7703I	5	IDVCC	17	CLKN	29	TP_VCI			5	TP_RESET
Display Direction	<input type="checkbox"/> 6	Operation Temperature	-20~+70	6	RESET	18	GND	30	NC			6	TP_VCI
	<input type="checkbox"/> 12		7	TE	19	D2P			7	NC			
Contrast Ratio	1200:1	Storage Temperature	-30~+80	8	NC	20	D2N						
Luminance	250(Typ.) 200(Min.)	Environmental Requirements	<input checked="" type="checkbox"/> RoHS-2.0	9	GND	21	GND						
	80% Min		Unmarked Tolerance	±0.2mm	10	D0P	22	D3P					
Uniformity	80% Min	Unmarked Tolerance	±0.2mm	11	D0N	23	D3N						
				12	GND	24	GND						

DRAWN	LCF	TITLE	Drawing NO: FN0400D002A
CHECKED	DONG		
APPROVED	1824	MODULE SPEC.	Project No:
CSR APPROVED			
Customer No:			
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### 3.0 ABSOLUTE MAXIMUM RATINGS /绝对最大额定值

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

Parameter	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI/VDD	-0.3	6.6	V
Digital interface supple Voltage	IOVCC	-0.3	5.5	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Operating Ambient Humidity	H <sub>OP</sub>	10	60°C 90%RH	RH
Storage Humidity	H <sub>ST</sub>	10	60°C 90%RH	RH

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

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**4.0 ELECTRICAL SPECIFICATIONS/电气规范****4.1 TFT LCM Module**

[Ta =25 ± 2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit
Digital supply voltage	VCI/VDD	2.5	2.8	3.6	V
Digital interface supply Voltage	IOVCC	1.6	1.8	3.6	V
Normal mode Current consumption	IDD	-	-	30	mA
Level input voltage	V <sub>IH</sub>	0.7IOVCC		IOVCC	V
	V <sub>IL</sub>	GND		0.3IOVCC	V
Level output voltage	V <sub>OH</sub>	0.8IOVCC		IOVCC	V
	V <sub>OL</sub>	GND		0.2IOVCC	V

**4.2 Backlight Driving Conditions /背光驱动条件**

[Ta =25 ± 2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Forward Current Voltage	V <sub>F</sub>	2.8	3.1	3.3	V	Note 1
Forward Current	I <sub>f</sub>	-	40	-	mA	
Backlight Power Consumption	W <sub>bl</sub>	-	0.124	-	W	
LED Life Time	-	30000	-	-	Hrs	Note 2

Note1: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note2: Optical performance should be evaluated at Ta=25°C. 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.

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**5.0 Interface Description/接口说明**

Connector Name/Designation	Interface Connector/Interface Card
Type Part Number	FPC 30PIN 0.5Pitch
Mating Housing Part Number	FH28-30S-0.5SH

**5.1 Pin assignment for LCM module /模组引脚分配**

Pin No.	Symbol	Description	Note.
1	LEDA	LED Anode	
2-3	LEDK	LED Cathode	
4	VCI	Power Supply 2.8V	
5	IOVCC	LCD I/O power supply 1.8V	
6	RESET	Reset pin	
7	TE	Tearing effect 1.8V	
8	NC	No connection	
9	GND	Ground	
10	D0P	MIPI DSI differential data pair (Data lane 0+)	
11	D0N	MIPI DSI differential data pair (Data lane 0-)	
12	GND	Ground	
13	D1P	MIPI DSI differential data pair (Data lane 1+)	
14	D1N	MIPI DSI differential data pair (Data lane 1-)	
15	GND	Ground	
16	CLKP	MIPI DSI differential clock pair	
17	CLKN	MIPI DSI differential clock pair	
18	GND	Ground	
19	D2P	MIPI DSI differential data pair (Data lane 2+)	
20	D2N	MIPI DSI differential data pair (Data lane 2-)	
21	GND	Ground	
22	D3P	MIPI DSI differential data pair (Data lane 3+)	
23	D3N	MIPI DSI differential data pair (Data lane 3-)	
24	GND	Ground	

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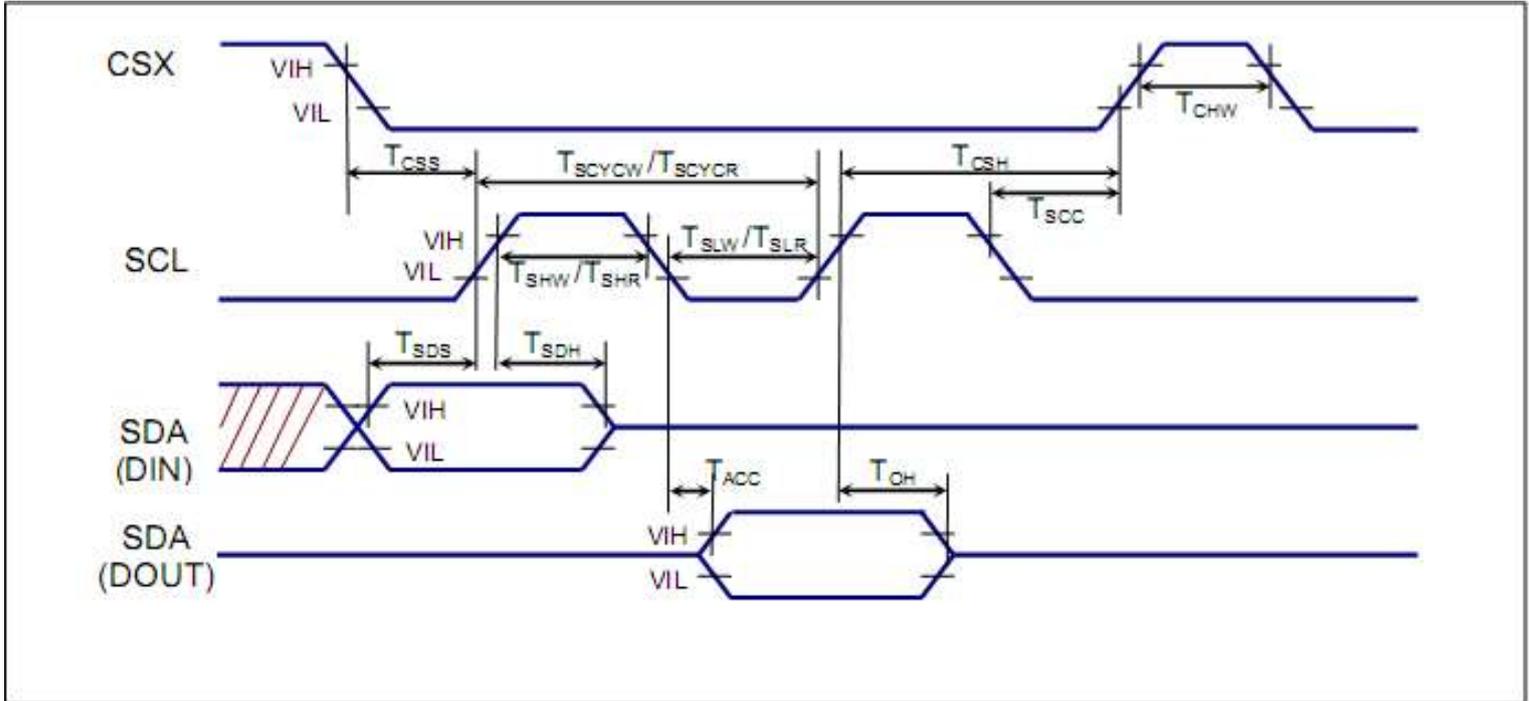
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<b>Pin No.</b>	<b>Symbol</b>	<b>Description</b>	<b>Note.</b>
25	TP_INT	Touch Interrupt, No Connection	
26	TP_SDA	Touch IIC Data signal, No Connection	
27	TP_SCL	Touch IIC Clock signal, No Connection	
28	TP_RESET	Touch Reset Signal, No Connection	
29	TP_VCI	Touch Power supply, No Connection	
30	NC	No Connection	

## 5.2 AC Characteristic

### 5.2.1 Serial Interface Characteristics



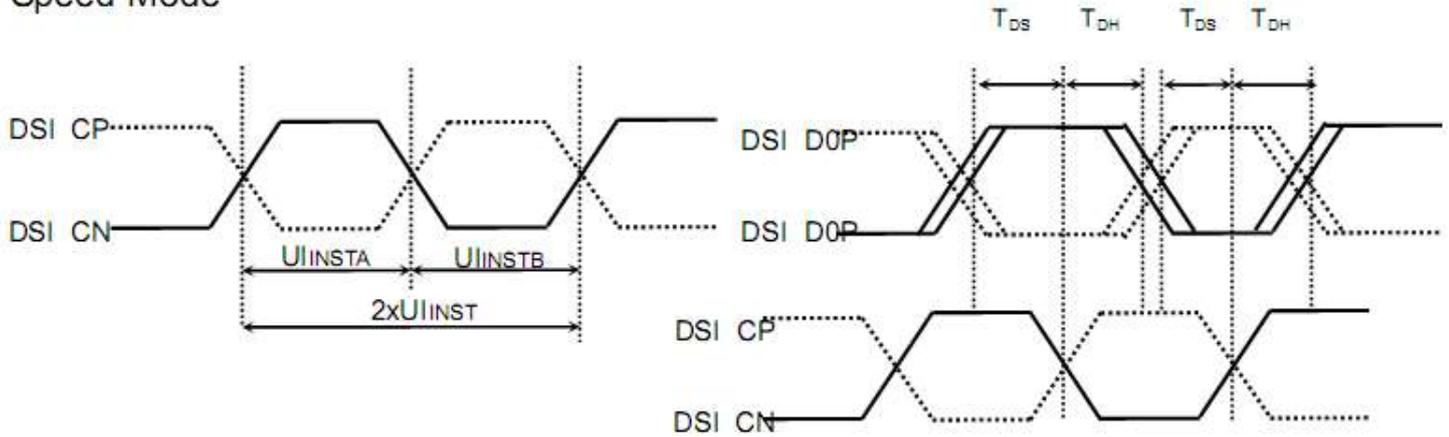
(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T<sub>A</sub> = 25°C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t <sub>CSS</sub>	Chip select setup time (Write)	15	-	ns	-
	t <sub>CSS</sub>	Chip select setup time (Read)	60	-		
	t <sub>CSH</sub>	Chip select hold time (Write)	15	-		
	t <sub>CSH</sub>	Chip select hold time (Read)	65	-		
DCX	t <sub>AST</sub>	Address setup time	0	-	ns	-
	t <sub>AHT</sub>	Address hold time (Write/Read)	10	-		
SCL (Write)	t <sub>WC</sub>	Write cycle	66	-	ns	-
	t <sub>WRH</sub>	Control pulse "H" duration	15	-		
	t <sub>WRL</sub>	Control pulse "L" duration	15	-		
SCL (Read)	t <sub>RC</sub>	Read cycle	150	-	ns	-
	t <sub>RDH</sub>	Control pulse "H" duration	60	-		
	t <sub>RDL</sub>	Control pulse "L" duration	60	-		
SDA (Input)	t <sub>DS</sub>	Data setup time	10	-	ns	For maximum C <sub>L</sub> =30pF For minimum C <sub>L</sub> =8pF
	t <sub>DH</sub>	Data hold time	10	-		
SDA (Output)	t <sub>ACC</sub>	Read access time	-	100	ns	
	t <sub>OH</sub>	Output disable time	10	-		

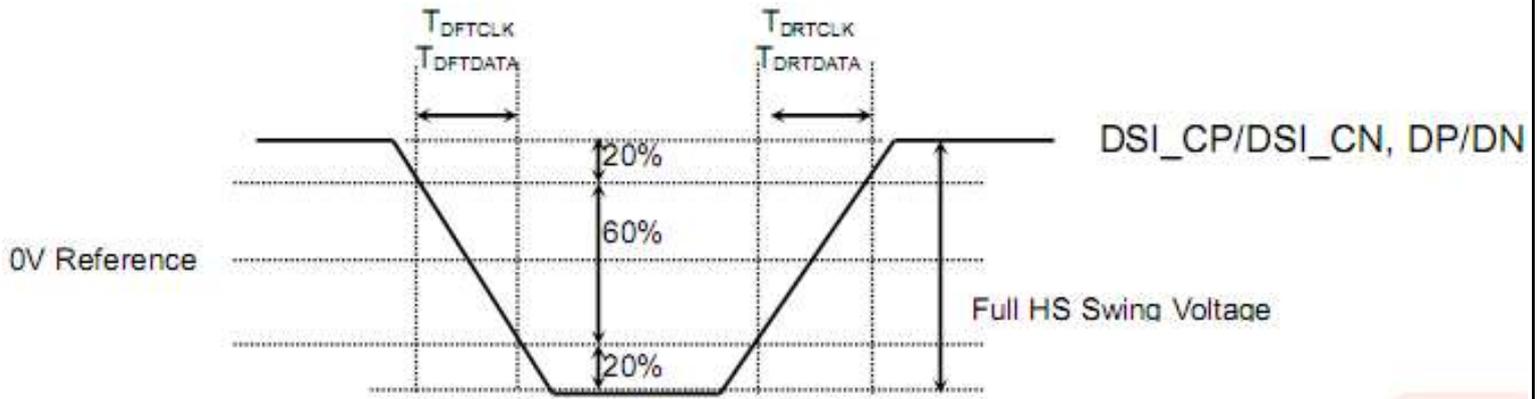
**Note:** The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.  
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

### 5.2.2 DSI Interface Timing Characteristics

#### High Speed Mode



#### DSI clock timing Characteristics

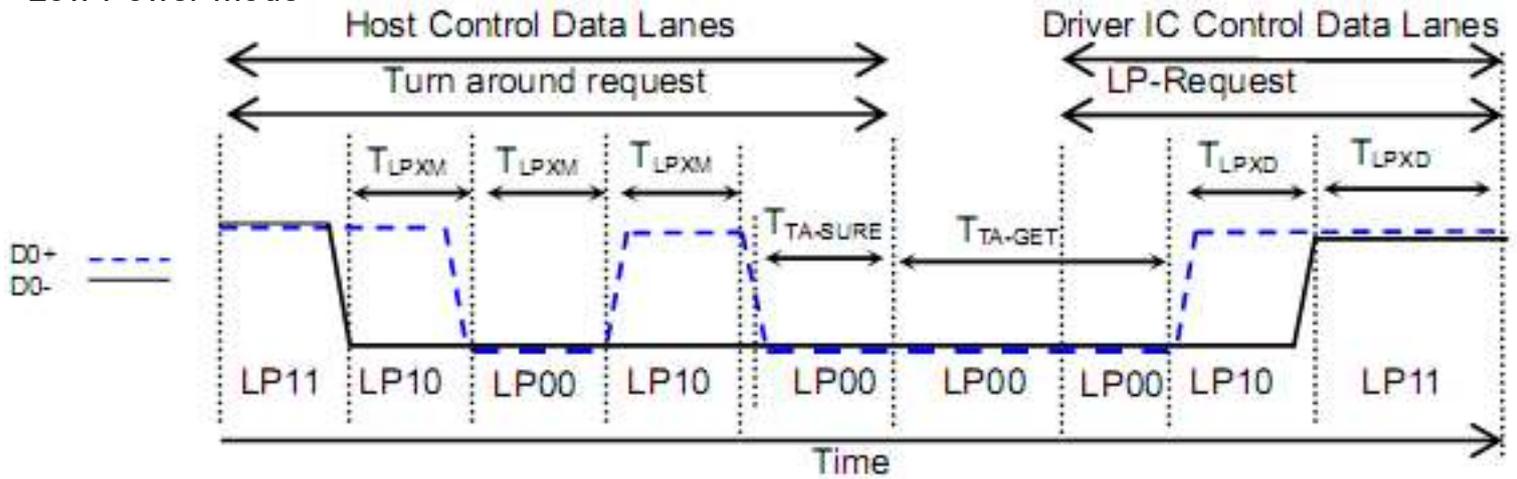


#### Rising and falling time on clock and data channel

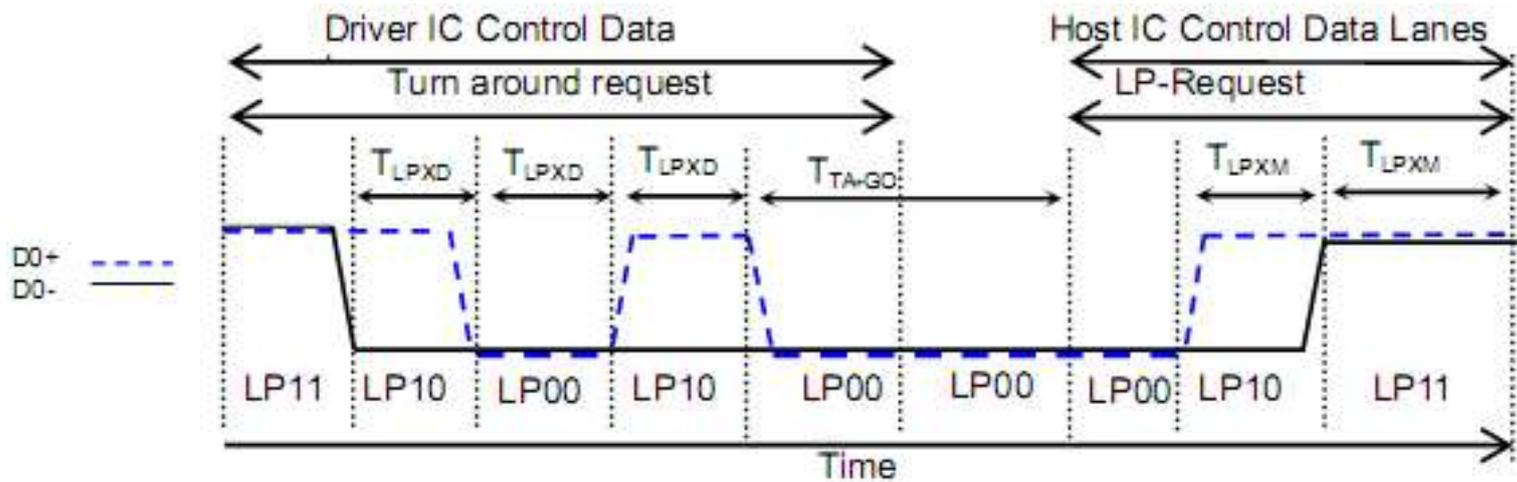
(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, T<sub>A</sub> = -30 to 70°C)

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

Low Power Mode



**BTA from HOST to Display Module Timing**

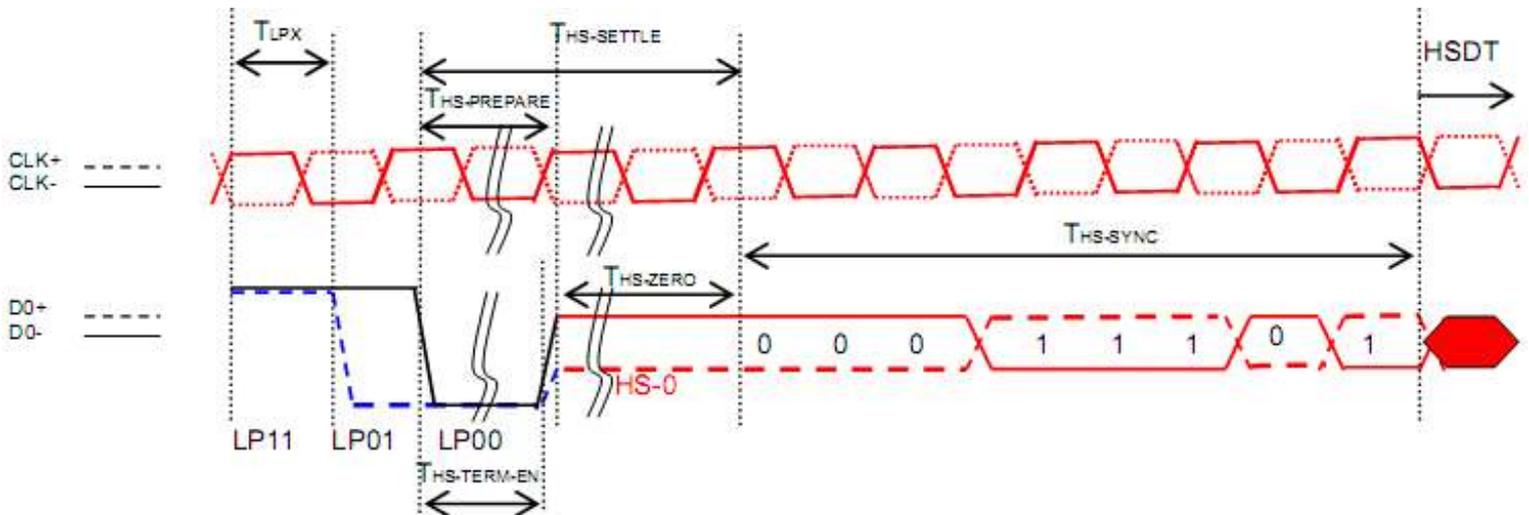


**BTA from Display Module Timing to HOST**

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T<sub>A</sub> = -30 to 70°C)

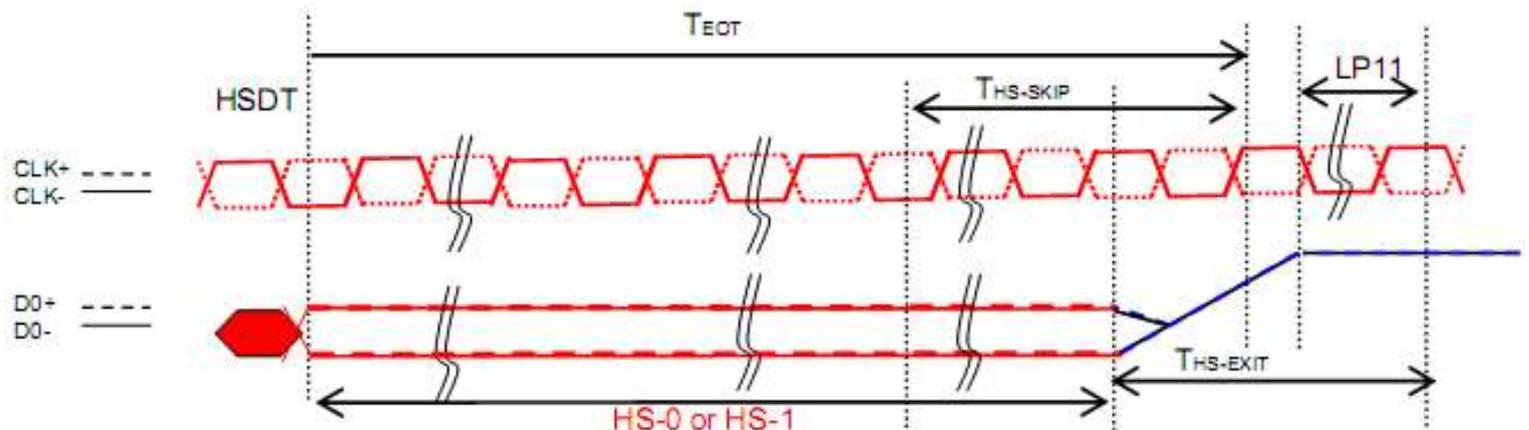
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host → Display module	T <sub>LPXM</sub>	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	T <sub>LPXD</sub>	50	-	-	ns
	Time-out before the MPU start driver	T <sub>TA-SURE</sub>	T <sub>LPXD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

**DSI Low PowerMode Characteristics**



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T <sub>LPX</sub>	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	T <sub>HS-PREPARE</sub>	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	T <sub>HS-TERM-EN</sub>	-	-	35+4xUI	ns
	Time to drive LP-00 by display module	T <sub>TA-GET</sub>	5xT <sub>LPXD</sub>	-	-	ns
	Time to drive LP-00 after turnaround request Host	T <sub>TAGO</sub>	4xT <sub>LPXD</sub>	-	-	ns

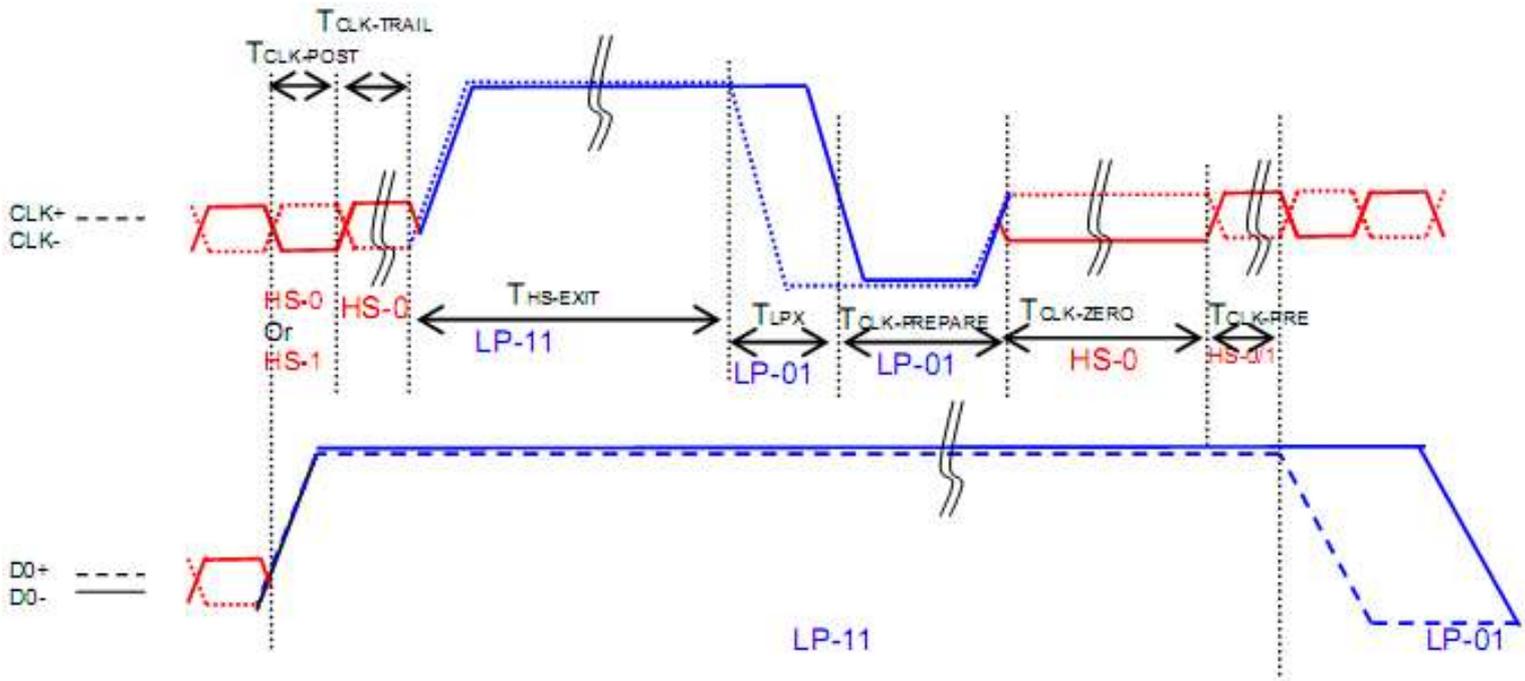
**DSI Low Power Mode to High Speed Mode Timing**



NOTE:  
 If the last bit is HS-0, the transmitter changes from HS-0 to HS-1  
 If the last bit is HS-1, 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 <sub>HS-SKIP</sub>	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	T <sub>HS-EXIT</sub>	100	-	-	ns

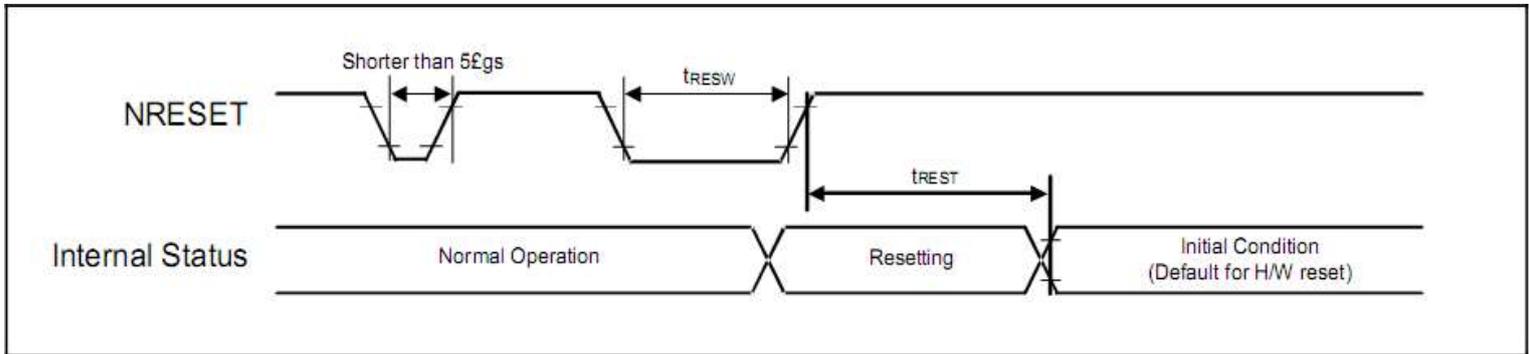
**DSI Low Power Mode to High Speed Mode Timing**



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 <sub>CLK-POST</sub>	60+52xUI	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	T <sub>CLK-TRAIL</sub>	60	-	-	ns
	Time to drive LP-11 after HS burst	T <sub>HS-EXIT</sub>	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	T <sub>CLK-PREPARE</sub>	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	T <sub>CLK-TERM-EN</sub>	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	T <sub>CLK-PREPARE</sub> + T <sub>CLK-ZERO</sub>	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 <sub>CLK-PRE</sub>	8xUI			

**Clock Lanes High Speed Mode to/from Low Power Mode Timing**

### 5.3 Reset input timing



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

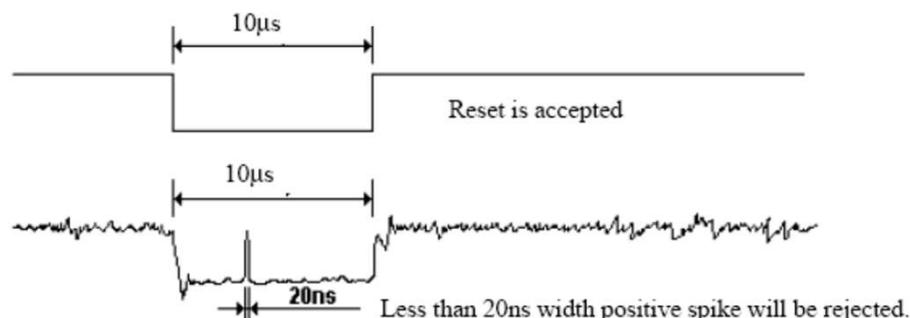
**Note:** (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the following table.

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 H/W 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 H/W reset complete time (tREST) within 15ms after a rising edge of NRESET.

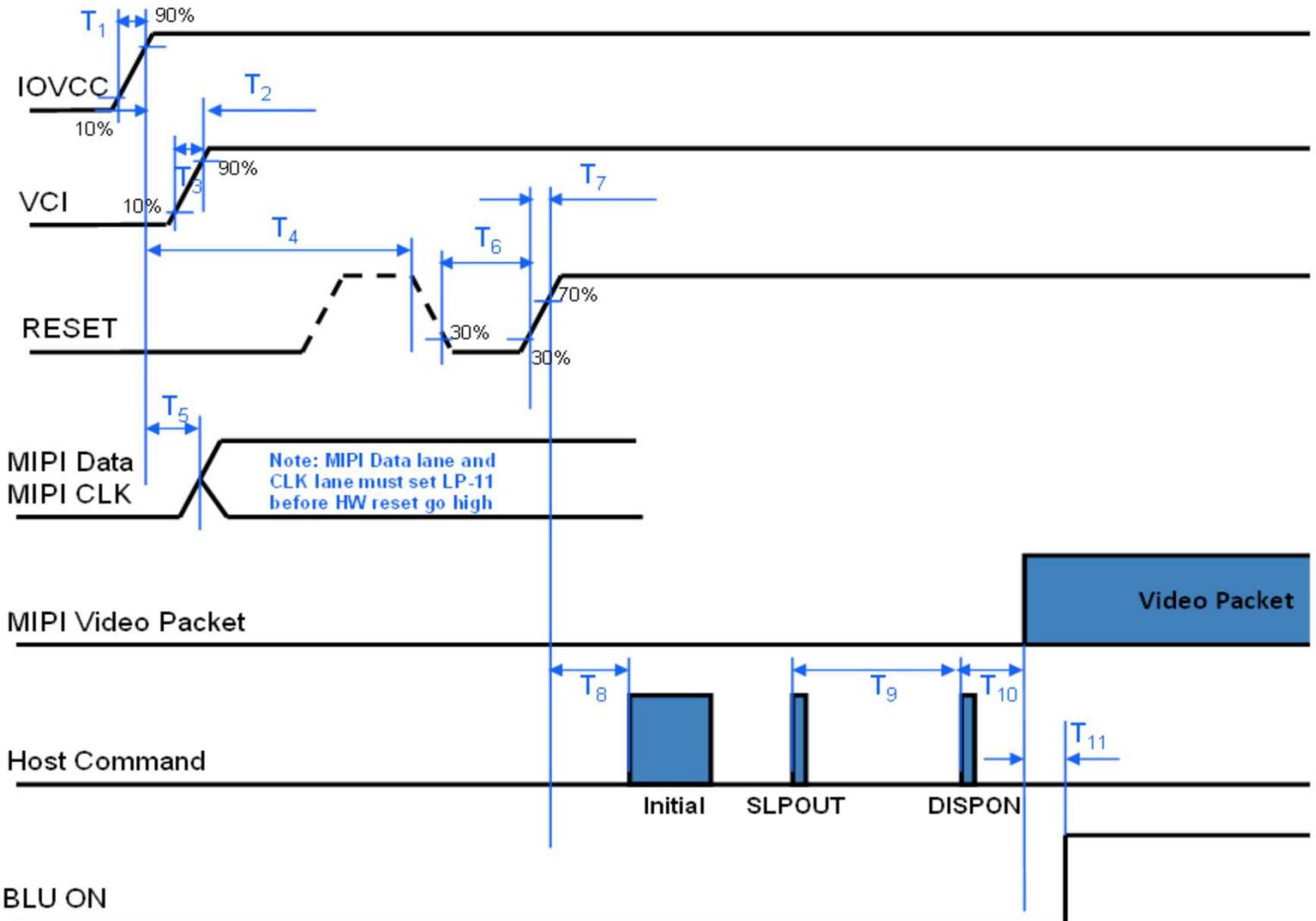
(4) Spike Rejection also applies during a valid reset pulse as shown as below:



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

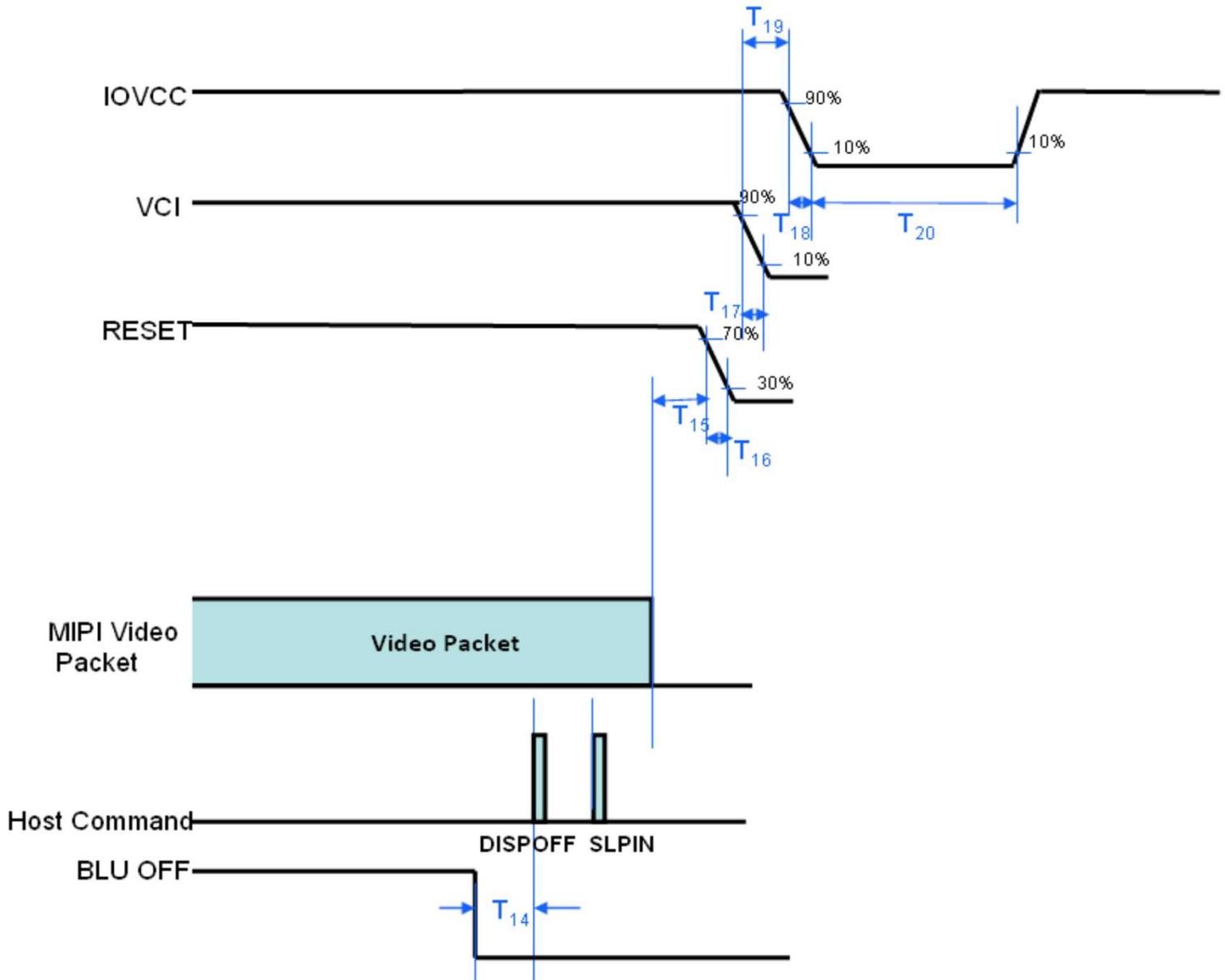
### 5.4 DSI Power On/Off Timing

#### 5.4.1 Power On Timing of External Power IC



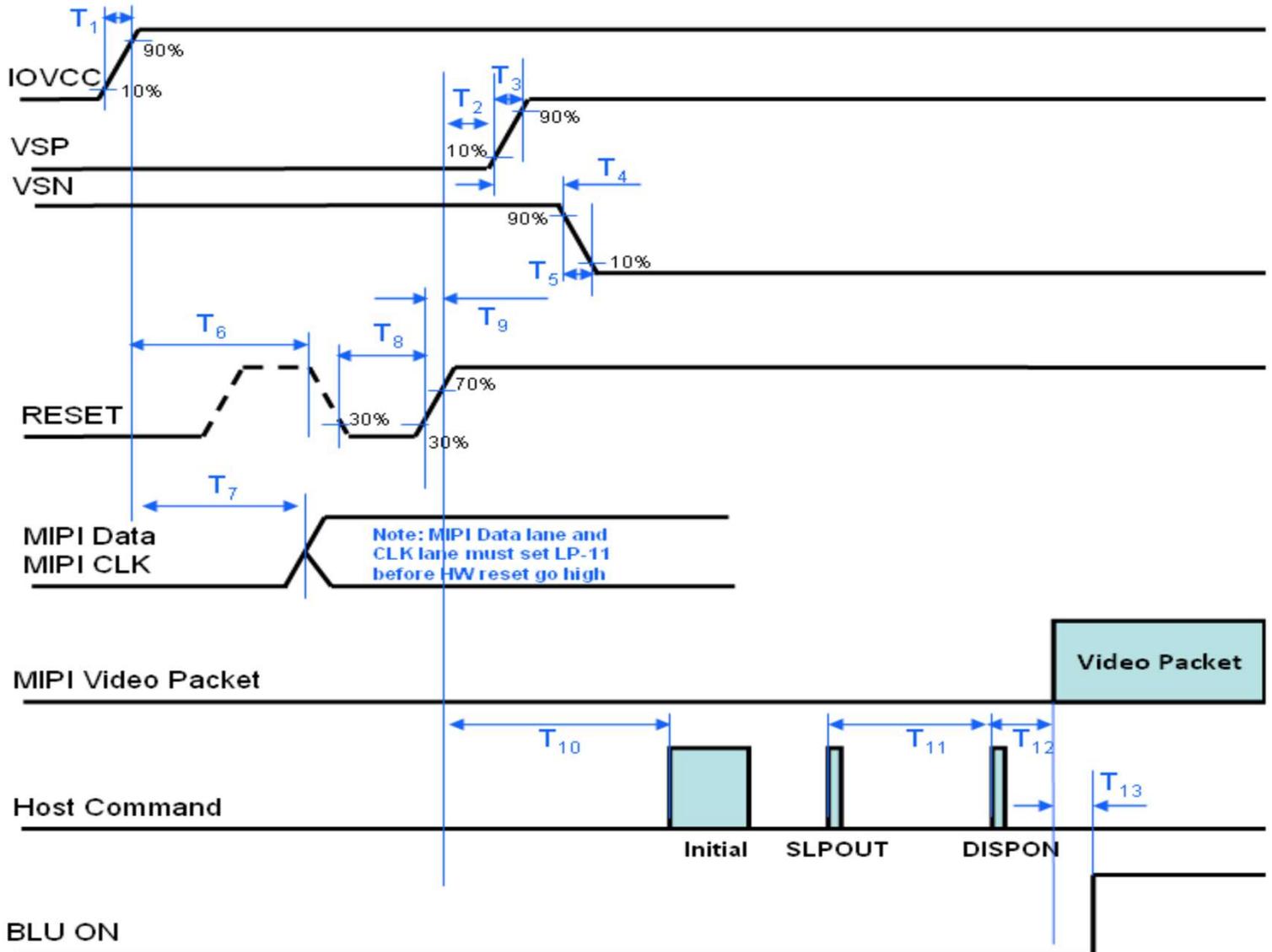
	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	No Limit			ms
T3	0.01	-	10	ms
T4	1	-	-	ms
T5	1	-	-	ms
T6	10	-	-	us
T7	No Limit			ns
T8	15	-	-	ms
T9	120	-	-	ms
T10	No Limit			ms
T11	100	150	-	ms

5.4.2 Power Off Timing of External Power IC



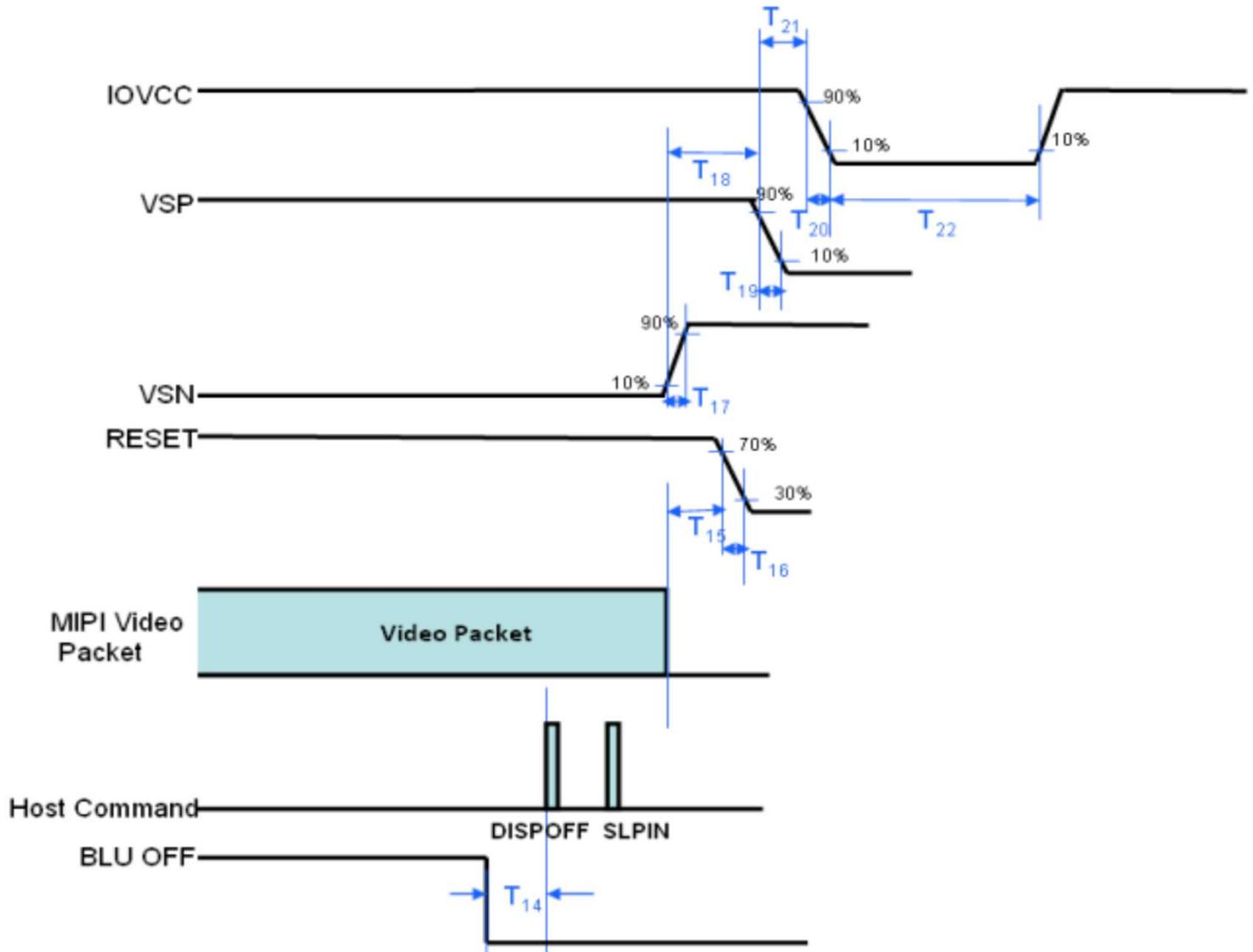
	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16	No Limit			ms
T17	No Limit			ms
T18	No Limit			ms
T19	No Limit			ms
T20	100			ms

5.4.3 Power On Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	10	-	-	ms
T3	0.01	-	10	ms
T4	No Limit			ms
T5	0.01	-	10	ms
T6	1	-	-	ms
T7	1	-	-	ms
T8	10	-	-	us
T9	No Limit			ns
T10	15	-	-	ms
T11	120	-	-	ms
T12	No Limit			ms
T13	100	150	-	ms

5.4.4 Power Off Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16		No Limit		ms
T17		No Limit		ms
T18		No Limit		ms
T19		No Limit		ms
T20		No Limit		ms
T21		No Limit		ms
T22	500	-	-	ms

## 6.0 OPTICAL SPECIFICATIONS /光学规格

### 6.1 Overview /概述

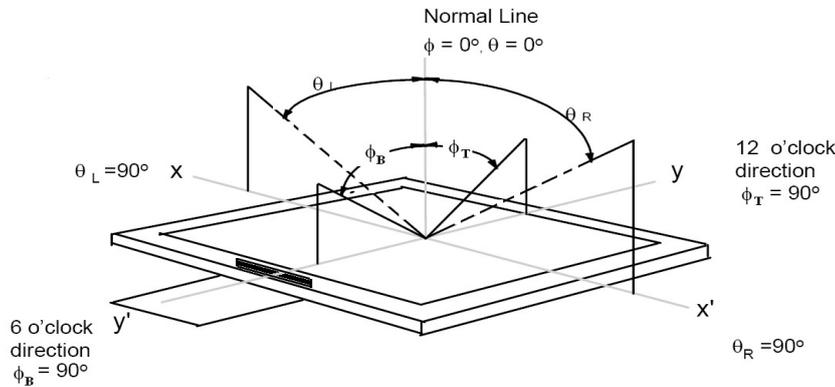
The test of optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$ lux and temperature =  $25 \pm 2^\circ\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\phi$  equal to  $0^\circ$ . We refer to  $\theta=0$  ( $=\theta_3$ ) as the 3 o'clock direction (the "right"),  $\theta=90$  ( $=\theta_{12}$ ) as the 12 o'clock direction ("upward"),  $\theta=180$  ( $=\theta_9$ ) as the 9 o'clock direction ("left") and  $\theta=270$  ( $=\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\theta$  and/or  $\phi$ , the center of the measuring spot on the display surface shall stay fixed.

### 6.2 Optical Specifications /光学规格

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Viewing Angle	$\theta_L$	$Cr \geq 10$	80	85	-	deg	Note 1
	$\theta_R$		80	85	-		
	$\psi_T$		80	85	-		
	$\psi_B$		80	85	-		
Contrast Ratio	Cr	$\theta=0^\circ$	1000	1200	-	-	Note 2
Response Time	Tr+Tf	FF=0°	--	30	35	ms	Note 3
Color Coordinate of CIE1931	Wx	$\theta=0^\circ$	0.265	0.295	0.325		Note 4
	Wy		0.300	0.330	0.360		
	Rx		0.605	0.635	.665		
	Ry		0.313	0.343	0.373		
	Gx		0.297	0.327	0.357		
	Gy		0.562	0.592	0.622		
	Bx		0.117	0.147	0.177		
	By		0.064	0.094	0.124		
Uniformity	U		80	--	--	%	Note 5
Color Gamut			55	60	--	%	
Luminance	L		200	250	--	cd/m <sup>2</sup>	Note 6

**Note 1: The definition of Viewing Angle**

Refer to the graph below marked by  $\theta$  and  $\phi$ .



**Note 2: The definition of Contrast Ratio**

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

**Note 3: Definition of Response time.** (Test LCD using RD80S or similar equipments):

The output sign also photo detector are measured when the input sign also are changed from "black" to "white" (Voltage falling time) and from "white" to "black" (Voltage rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figures below.

**Note 4: Color Coordinates of CIE 1931**

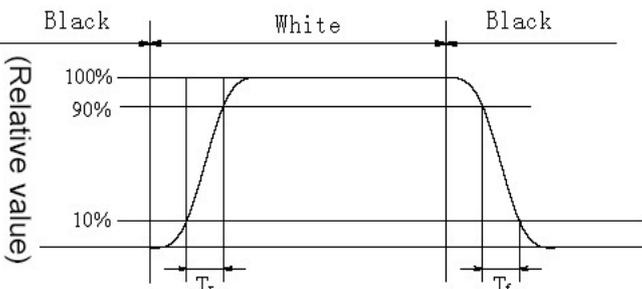
The test condition is at ILED=20mA and measured on the surface of LCD module at 25°C.

Measurement equipment: CS2000 or similar equipments

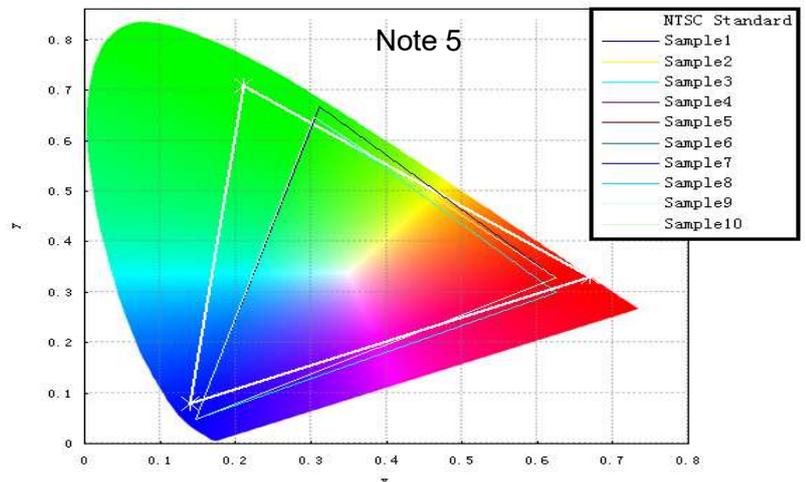
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

**Note 5: Definition of Color of CIE Coordinate and NTSC Ratio.**

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



Note 3



## 7.0 RELIABILITY TEST /可靠性测试

The Reliability test items and its conditions are shown in below.

No	Test Items	Conditions	Testing standard
1	High temperature storage Test	Ta=+80°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low temperature storage Test	Ta=-30°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High temperature operation Test	Ta=+70°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low temperature operation Test	Ta=-20°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	High temperature & humidity (storage Test)	Ta=+60°C, 90%RH max, 240 hours	IEC60068-2-78:2001 GB/T2423.3-2006
6	Thermal shock Test	-30°C 30min~80°C 30min, Change time:5min 10cycle	Start with cold temperature End with high temperature IEC60068-2-14:1984,GB2423.22-2002
7	Vibration Test	Frequency range:10Hz-55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z (6 hours for total)	IEC60068-2-6 GB/T17626.2
8	Mechanical shock	Half Sine Wave 100G 6ms,+X,+Y,+Z 3times for each direction	IEC60068-2-27 GB/T2423.5
9	Dropping Test	Height: 60 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8-1995
10	ESD Test	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5times; (Environment:15°C~35°C, 30%~60%RH,86Kpa a~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006 Class C

### Notes:

- 1、Maximum acceleration 20g, 1g=9.8m/s<sup>2</sup>
- 2、Maximum amplitude 5mm
- 3、Maximum acceleration =0.002 x F<sup>2</sup> (frequency Hz) x D (amplitude p-pmm)

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- **8.0 Precautions /注意事项**

- Please pay attention to the followings when you use this TFT LCD Panel.

- **8.1 Mounting Precautions /安装注意事项**

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.
- Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.
- Do not strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- (13) Do not drop water or any chemicals onto the LCD's surface.

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## 8.2 Operating Precautions /操作注意事项

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.  
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) For the Q/Single/OC Product, If the LED designed side view, LED bar should be putted in the Long/short side ; Otherwise, its reliability and function may not be guaranteed.

注：  
 ①(1)涉及到Pol相关条目适用于OC/MDL出货产品，  
 ②(6)(7)涉及到connector相关适用于OC/MDL出货产品  
 ③ (12) 涉及到客户进行BLU设计， LED Bar位置需要避开GOA位置；

## 8.3 Electrostatic Discharge Control /静电放电控制

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

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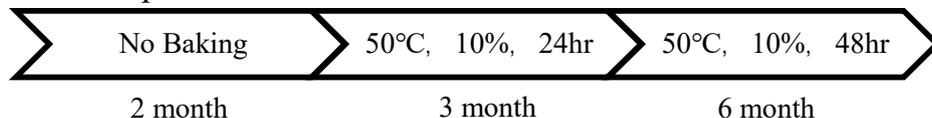
#### 8.4 Precautions for Strong Light Exposure / 强光照射注意事项

It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

#### 8.5 Storage Precautions / 存储注意事项

When storing modules as spares for a long time, the following precautions are necessary.

- (1) The polarizer surface should not come in contact with any other object.  
It is recommended that they be stored in the container in which they were shipped.  
Temperature : 5 ~ 40 °C
- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture.  
Be careful for condensation.
- (6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
- (7) Do not store the LCD near organic solvents or corrosive gasses.
- (8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.



#### 8.6 Precautions for Protection Film / 保护膜注意事项

- (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

#### 8.7 Appropriate Condition for Display / 适当的显示条件

- (1) Normal operating condition
  - Temperature: 0 ~ 40°C
  - Operating Ambient Humidity : 10 ~ 90 %
  - Display pattern: dynamic pattern (Real display)
  - Suitable operating time: under 12 hours a day.
- (2) Special operating condition  
If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7\*24hrs operation time etc., It is strongly recommended to contact us for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.
- (3) Black image or moving image is strongly recommended as a screen save.

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- (4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.
- (5) Please contact us in advance when you display the same pattern for a long time.
- (6) If the Module keeps displaying the same pattern for a long period of time, the image may be “sticked“ or “turn off” to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (7) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (8) Dew drop atmosphere should be avoided.
- (9) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.
- (10) The LCD should be avoided to expose to corrosive gas for long time, ,the LCD may be affected by the gas as SO<sub>2</sub> ,H<sub>2</sub>S etc.
- (11) When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (12) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation

## 8.8 Others /其他

### A. LC Leak /液晶泄露

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

### B. Rework /返工

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

- C. In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line (适用于Q/Single/OC出货产品)

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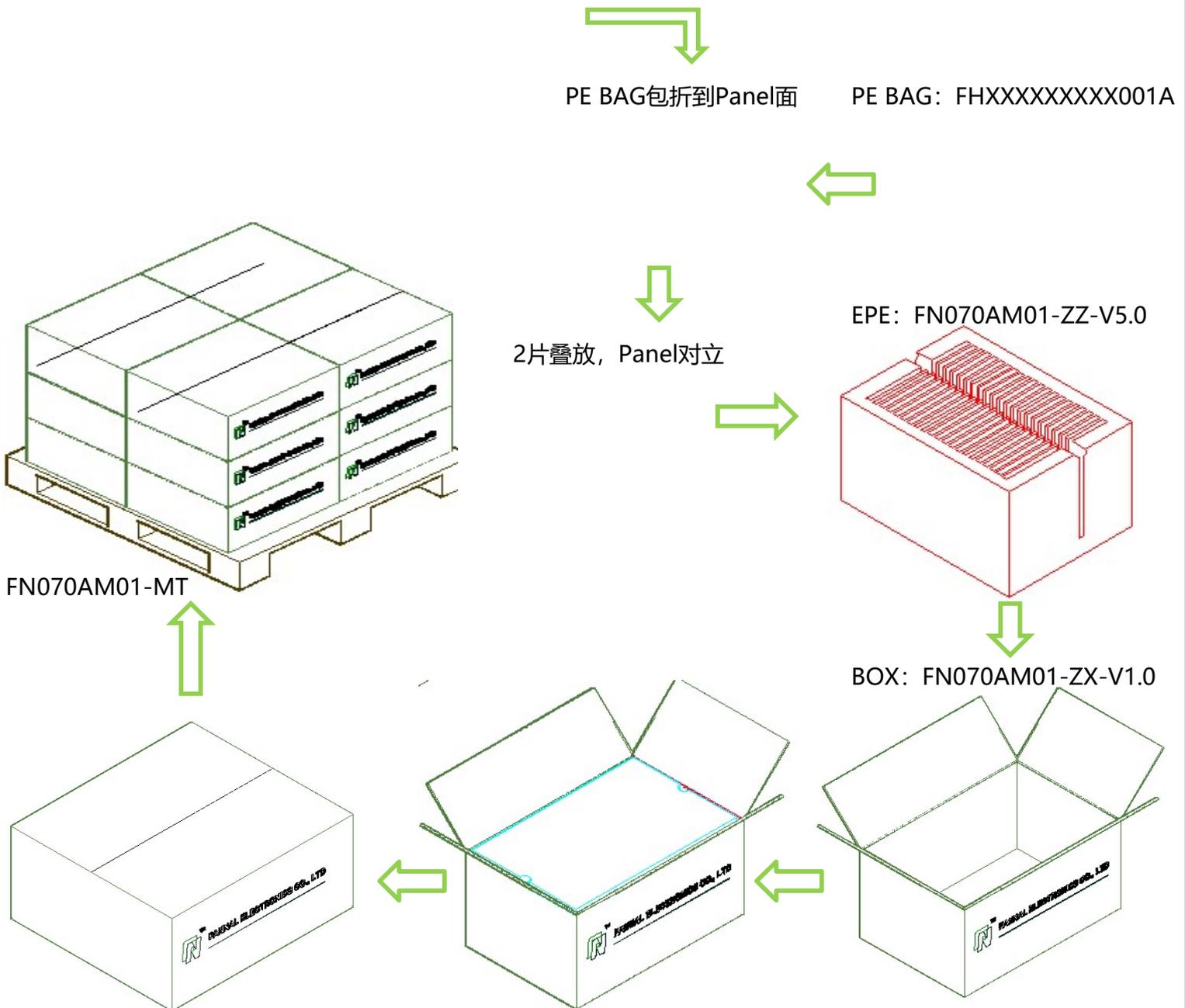
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### 9.0 PACKING INFORMATION(产品形态: LCM )

LCM MODEL	LCM Qty. in the Box	Carton Size(mm)	LCM Qty. in the Pallet
TBD			



## 10.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTOMERS /所有客户的目视检查标准

### 10.1 Sampling Method /抽样方法

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customers incoming inspection.

- 10.1.1 Lot size : 1 pallet per same model
- 10.1.2 Sampling type : Random sampling
- 10.1.3 Inspection level : II
- 10.1.4 Sampling table : MIL-STD-105E

### 10.2 Inspection Environment /检验环境

#### 10.2.1 Ambient conditions

- a. Ambient Temperature:  $25 \pm 3^{\circ}\text{C}$
- b. Relative Humidity:  $65 \pm 20\% \text{RH}$
- c. Ambient Illumination: 300-700LUX (Normal: 500LUX)

#### 10.2.2 Viewing Distance

The distance between the LCM and the inspector's eyes shall be at least 30cm-50cm

#### 10.2.3 Viewing Angle

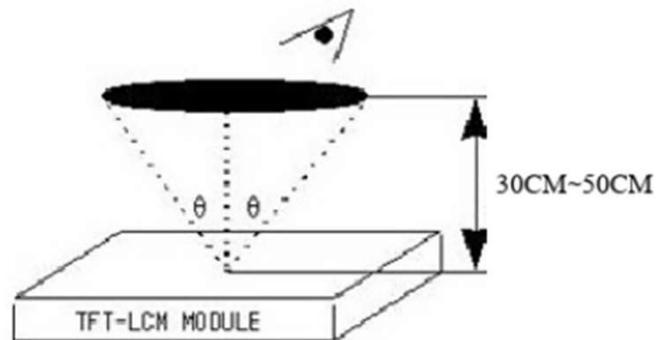
performing in front of the panel

[Vertical] :  $\pm 25^{\circ}$

[Horizontal] :  $\pm 40^{\circ}$

#### 10.2.4 Inspection Area:

Display Area (Active Area)



### 10.3 Definitions /定义

#### 10.3.1 Dark / Bright Spots

Points on display which appear dark/bright and usually result from the contamination.

These defects do not vary in size or intensity (contrast) when contrast is varied.

#### 10.3.2 Dark / Bright Lines

Lines on display which appear dark/bright and usually result from the contamination.

#### 10.3.3 Polarizer Scratch

Lines on display which are seen across a darker background and do not vary in size.

#### 10.3.4 Polarizer Dent

White spots on display which appear against a darker background and do not vary in size.

#### 10.3.5 Bright Dot Defects

Dots (sub-pixels) on display which appear bright in the display area and visible through the 5%ND filter at Black Pattern.

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#### 10.3.6 Dark Dot Defects

Dots(sub-pixels)on display which appear dark in the display area at R.G.B Color Pattern.

#### 10.3.7 Line Defects

All line defects on display which appear bright/dark such as vertical, horizontal, or cross lines.

#### 10.3.8 Mura

Mura on display which appears darker/brighter against background brightness on parts of display area.

#### 10.3.9 BM Defects

Bright(white)Points on display which are off BM(Black Matrix).

#### 10.3.10 Visual Inspection

Inspection for LCM when the unit turns on.

#### 10.3.11 Appearance Inspection

External inspection for LCM when the unit turns off.

#### 10.3.12 Other

Defects which cannot be classified into the above defect definitions.

Note 1: Bright& Dark dots are not smaller than a sub-pixel(Dots smaller than a sub-pixel are not counted as defect dots)

### 10.4 Inspectin Criteria /检验标准

Refer to 《TFT LCM general inspection standard》

### 10.5 Verification /验证

The supplier can verify the defective LCMs to segregate the responsibilities at customer's facility or can request the Customer to ship the defective LCMs to assigned place for verification

This verification result shall be agreed mutually by the Customer and Supplier. This result can be corrected/changed after detail failure analysis at Supplier's facilities.

### 10.6 Supplier Induced Defects /供应商引起的缺陷

All of the Supplier induced defective LCMs shall be returned to the Supplier for repair or replacement.

Before return the defective LCMs, the Customer needs Supplier's confirmation with RMA Number.

All of the returned LCMs shall be returned to the Customer within agreed time period.

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### 10.7 Customer Induced Defects /顾客引起的缺陷

The Customer can return the customer induced defective LCMs to the Supplier for repair. The repair cost for Customer induced defective LCMs shall be agreed with both parties, Customer and Supplier.

### 10.8 Warranty Period /质量保证期

In-warranty period is Eighteen(18)Months from manufacturing month of LCM

Note :

- a. Eighteen months are composed of twelfth months in-warranty period and sixth months distribution period
- b. The manufacturing Month is on the LCMs as Supplier's serial No.

### 10.9 Repair Warranty /维修保证书

Repair warranty is Twelve(12)Months from repaired month for repaired LCMs

Note : a. The Label for repair will be added after repairing.

### 10.10 Warranty avoidance /避免担保

The warranty will be avoided in cases of below:

- a. When the warranty period is expired.
- b. The Customer induced defective LCMs.
- c. When the LCMs were repaired by 3rd party without Supplier's approval.
- d. When the LCMs were treated like Disassemble and Rework by the Customer and/or Customer's representatives without Supplier's approval.

### 10.11 Others /其他

If any problems arise with the LCMs supplied by supplier, the customer and supplier will cooperate and make efforts to solve it with mutual confidence and respect